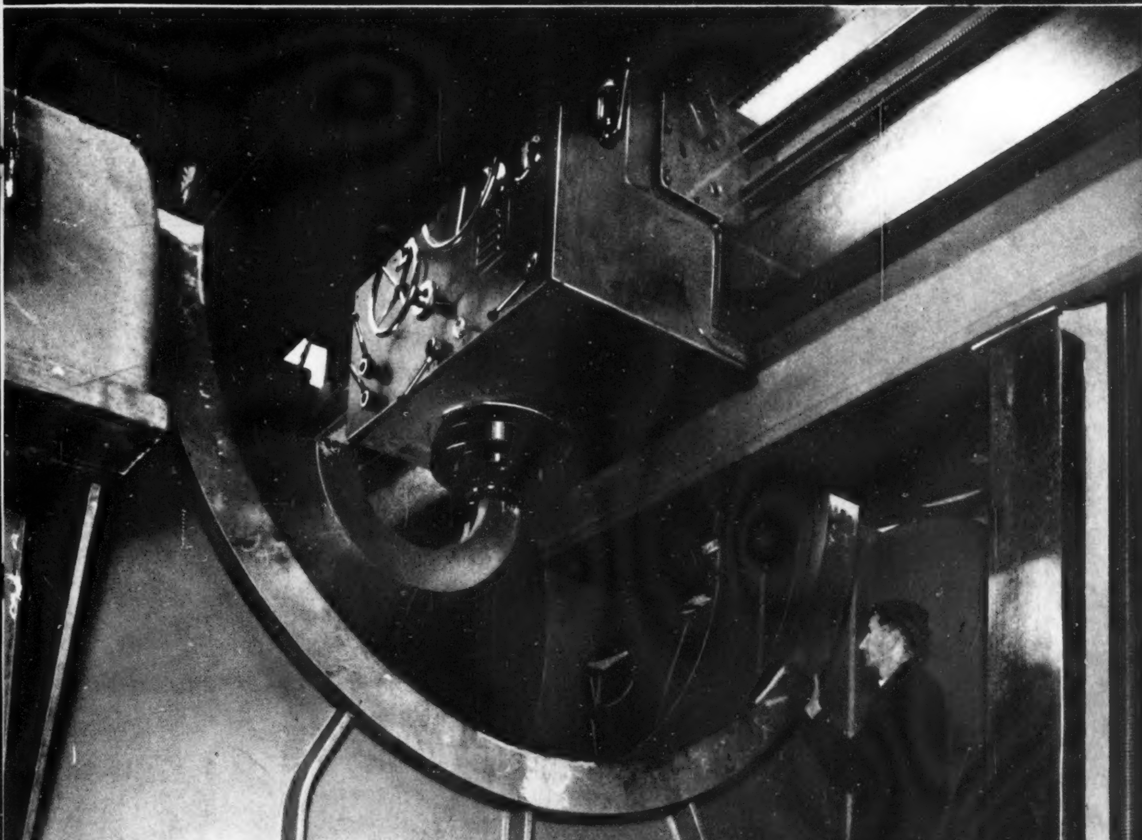
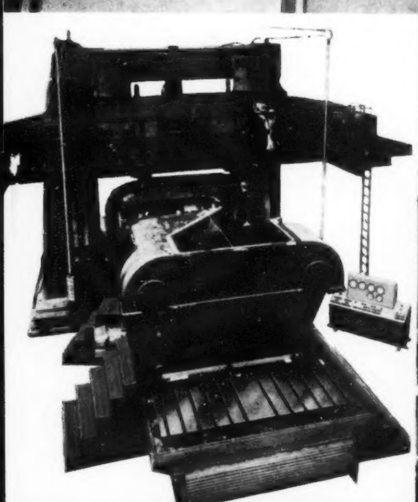
# MACHINERY

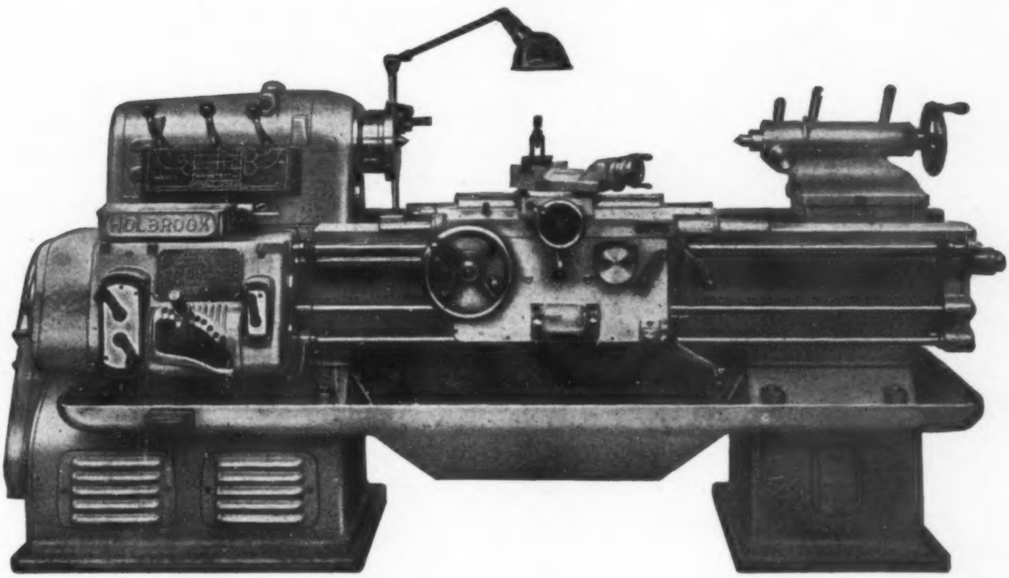
SEPTEMBER 17, 1958 ONE SHILLING & THREEPENCE





# Holbrook

**STRATFORD LONDON ENGLAND**




# MODEL "B"

## PRECISION TOOL-ROOM LATHES

Built in 3 Sizes
Swinging 13-17-21 inches over Bedways

Cam-lock Spindle Nose
Synchronizing-Reversing-Clutch for Threading and Feeds - Precision Lead-Screw with Compensating End Thrust - Enclosed Apron with Finger Tip Control for Feeds
Electric Suds Pump

*The Finest Lathe in its Class*

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*For all practical purposes, there is no limit to the size, ratio and type of worm reducer you can order from Holroyd. We can give immediate delivery of our standard units up to 12 inch centre distance, from a choice of 340 combinations of type, ratio and size shown in the table below. Reduction gears over 12 inch centre distance can usually be assembled for you fairly quickly. Send for the 50-page book about Holroyd worm speed reducers and you will always have complete details of the whole range by you for quick reference.*

| | |
|---|---|
| **Holroyd HU** | Single reduction underdriven with horizontal input and output shafts. Centre distances 3, 4, 5, 6, 7, 8, 9, 10 and 12 inches. |
| **Holroyd HO** | Single reduction overdriven with horizontal input and output shafts. Centre distances 3, 4, 5, 6, 7, 8, 9, 10 and 12 inches. |
| **Holroyd HV** | Single reduction with vertical output shafts and horizontal input. Centre distances 3, 4, 5, 6, 7, 8, 9, 10 and 12 inches. |
| **Holroyd Verso** | 2¼ inch centre distance. Suitable for underdriven, overdriven or side mounting. |
| **Holroyd F** | Made in three sizes—1⅛, 1¾ and 2¼ inch centre distance, and suitable for a variety of mounting positions. |
| All the above are available with any of the following ratios:—5, 7½, 10, 15, 20, 25, 30, 40, 50, 60 and 70 to 1. | |

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**90 YEARS OF GEARS**

JOHN HOLROYD & CO. LTD., MILNROW, LANCASHIRE

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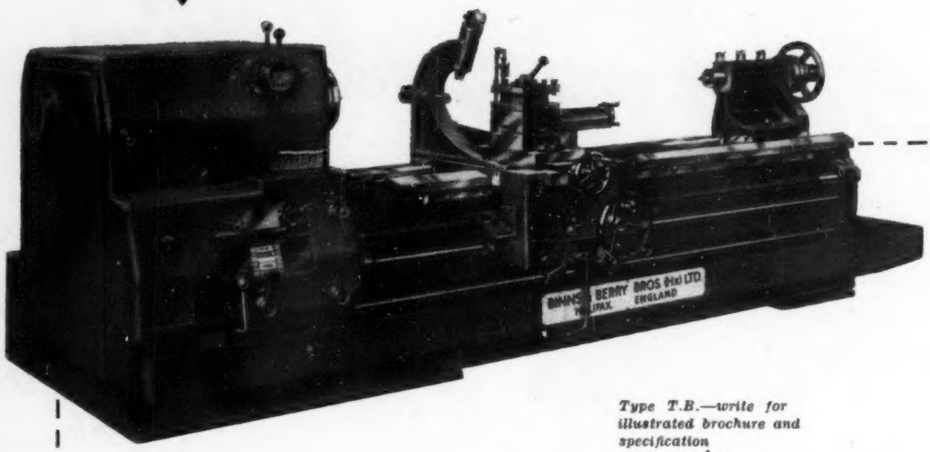


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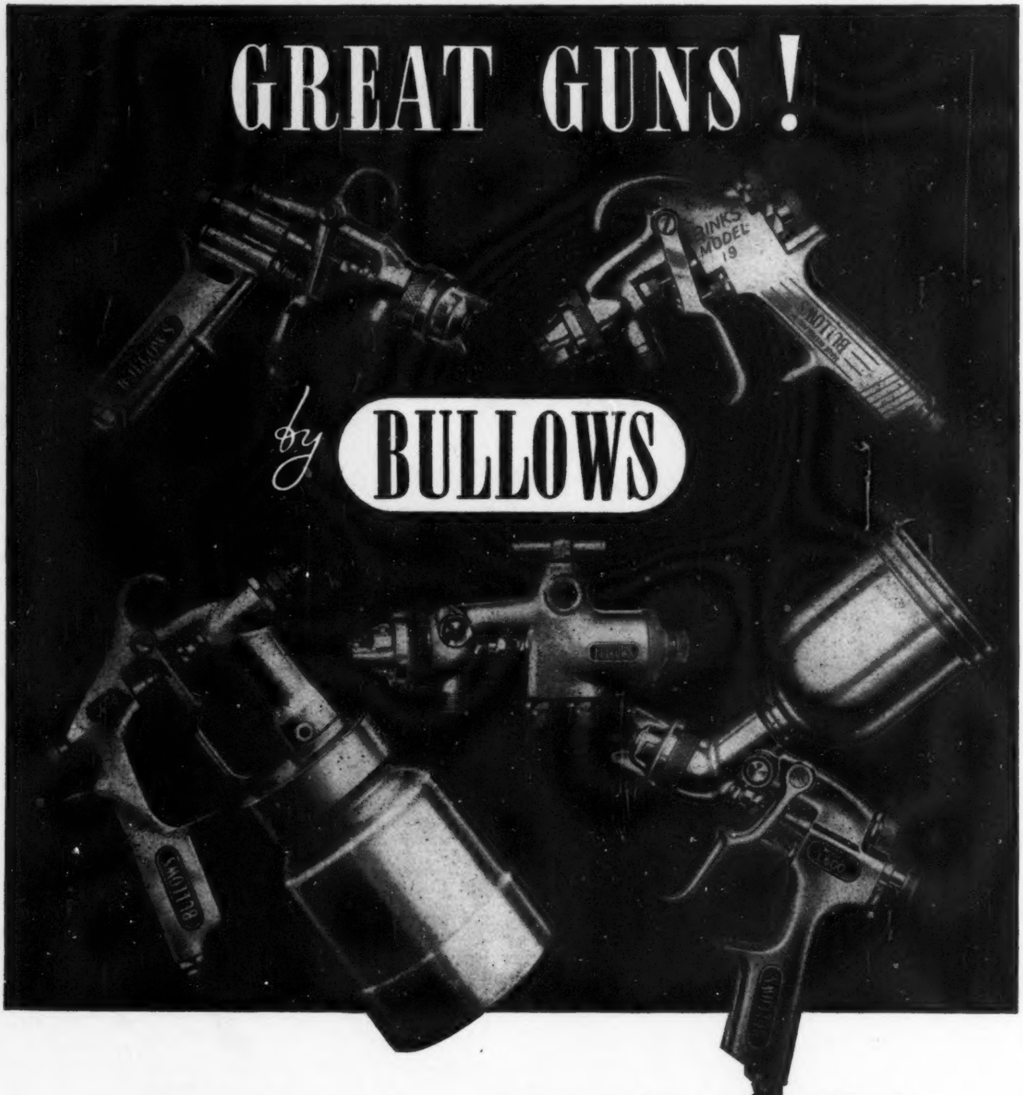


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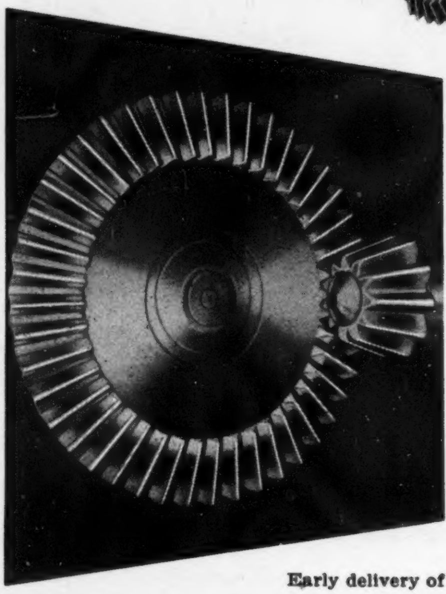

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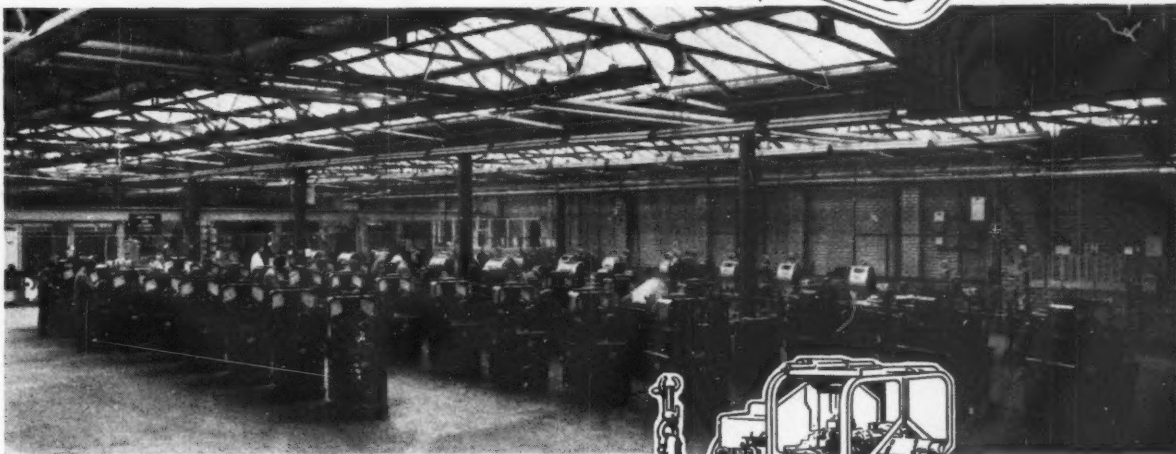

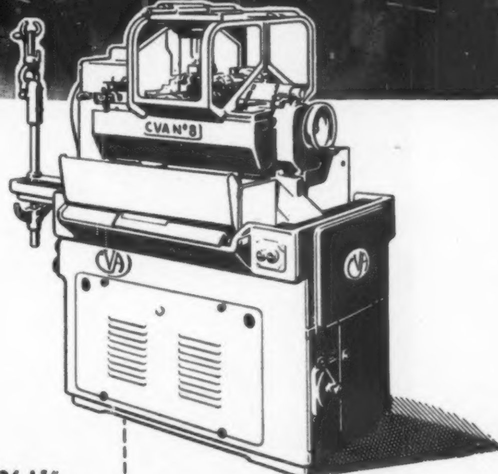
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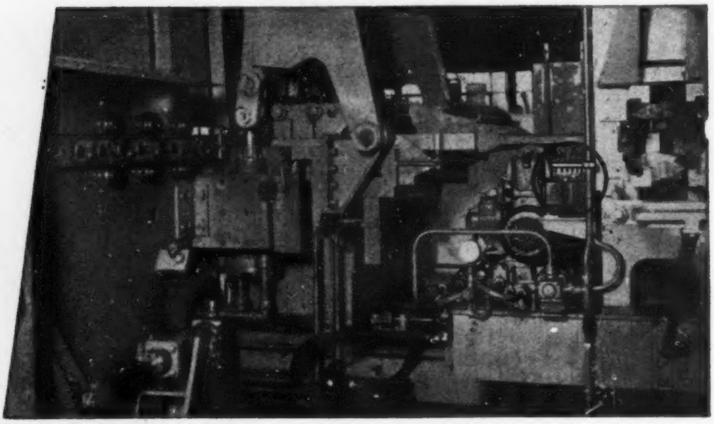

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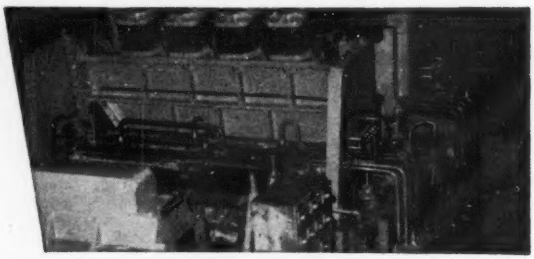

**This Strip line flash welder and stripper unit was made by the British Federal Welder & Machine Co. Ltd., for the Steel Company of Wales. When this intricate machine was at the planning stage, Tecalemit engineers were called in to advise on the best method of lubrication. A combination of three Tecalemit systems was ultimately selected: The 'Brentford' Automatic System for oiling, The 'Radial' Automatic Grease Pump, for greasing, and the Group Nipple System for use with grease or oil. All three systems are fundamentally simple and foolproof in operation, saving time and labour, eliminating human errors, and avoiding costly stoppages. Manufacturers of heavy machinery are invited to consult Tecalemit at an early stage to ensure that vital lubrication problems are expertly resolved by the most efficient and economical methods —designed specially for the job.**

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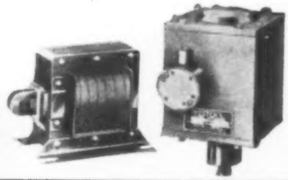

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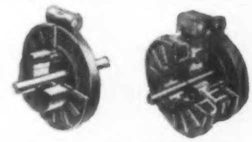

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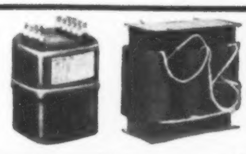

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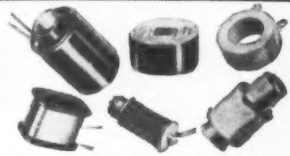

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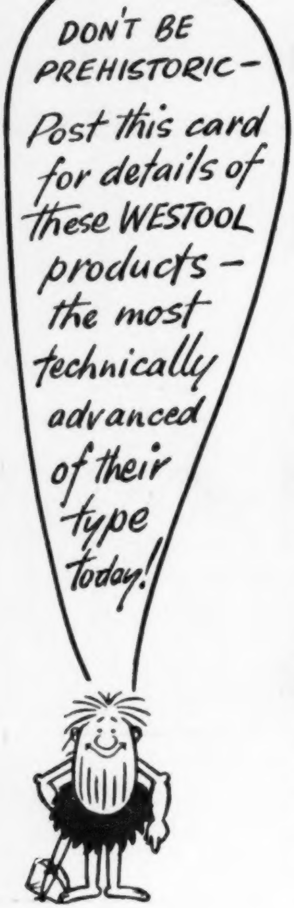


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Already in use on a multiplicity of applications, Westool Solenoids offer designers in many industries a convenient and uncomplicated means of mechanical actuation and control. Being electrically operated and self-contained, these units can be fitted almost anywhere to provide a prime mover right where it is needed. Westool Solenoids are design approved by The Ministry of Supply.


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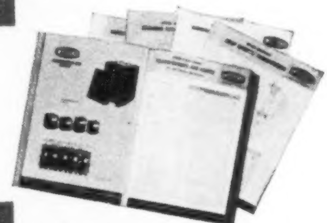

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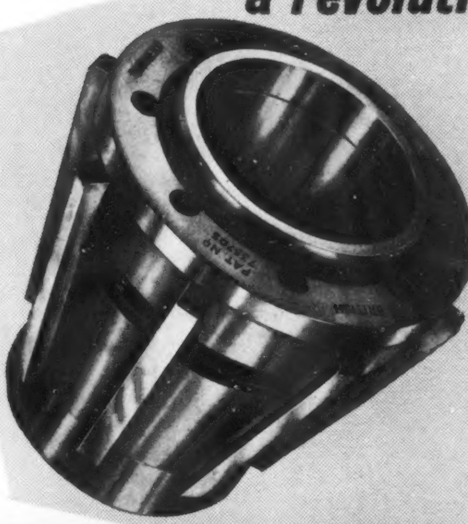
## a revolutionary NEW workholder



**SUPERLATIVE ACCURACY · GRIP · RIGIDITY**

### TEN FEATURES OF THE COLLET

- Powerful grip—MANY TIMES GREATER THAN SPRING COLLETS.
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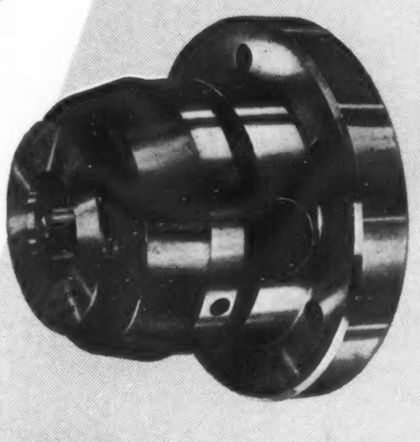
- Constant parallel grip throughout complete range of collet.
- Thin walled components gripped firmly without damage.

**This startling new workholder provides all the advantages of conventional spring collets combined with the flexibility of an adjustable jaw chuck. One "Multisize Collet" will replace at least 9 conventional collets and only 11 collets are required to cover a range of $\frac{1}{8}$" to $1\frac{1}{2}$". Several years of research and testing lie behind the "Multisize Collet" Write today for fully illustrated brochure.**



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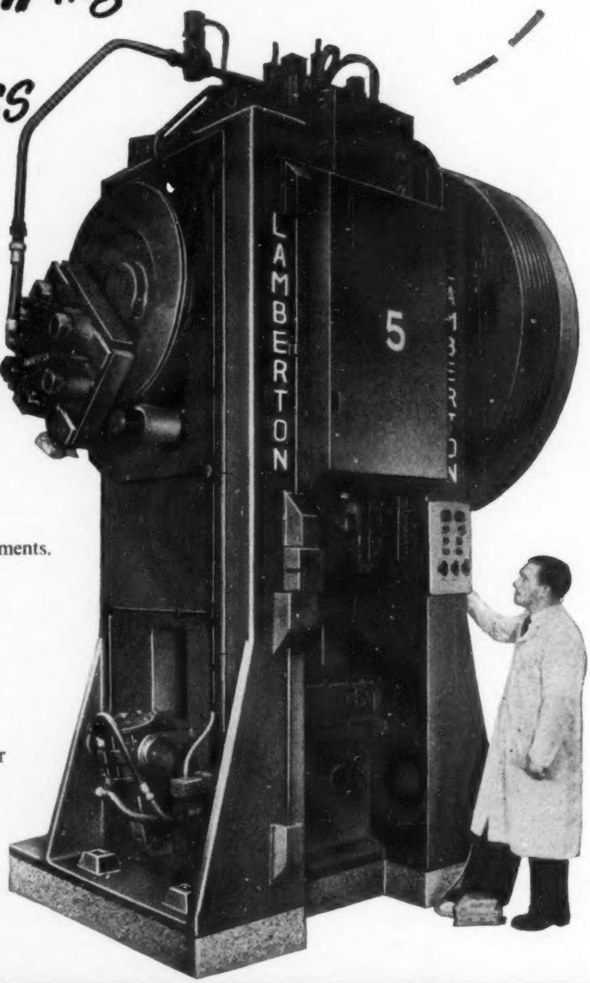


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air operated, adjustable to suit all requirements.

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can be limited to every second or third stroke as required.

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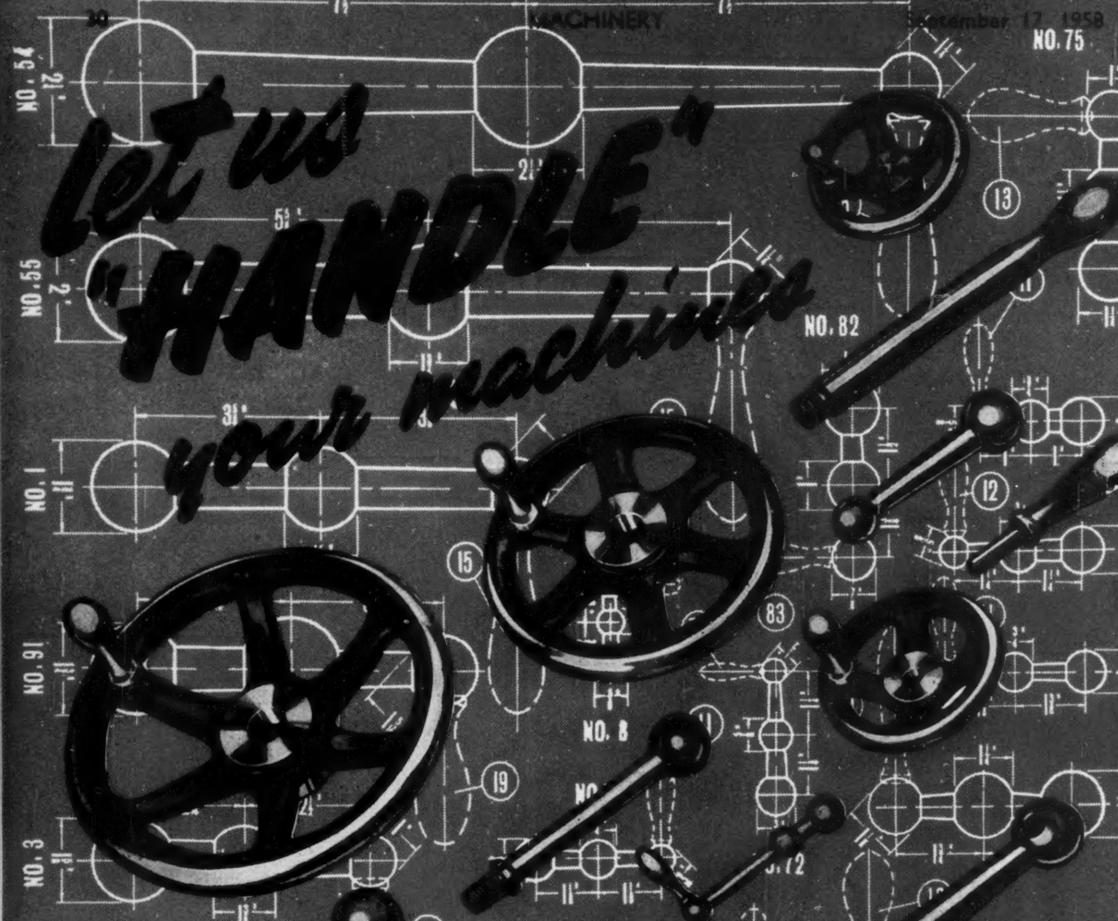


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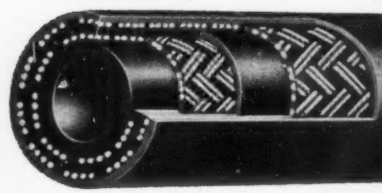
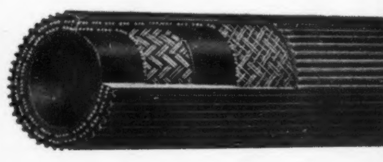


STYLE A *for service where oil mist may be present in the line, and where operating pressures up to 325 lbs. per sq. in. are used.*



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Full details of both types can be obtained from Industrial Rubber Products Dept., Goodyear, Wolverhampton. We will also be pleased to advise on any air hose problem you have.

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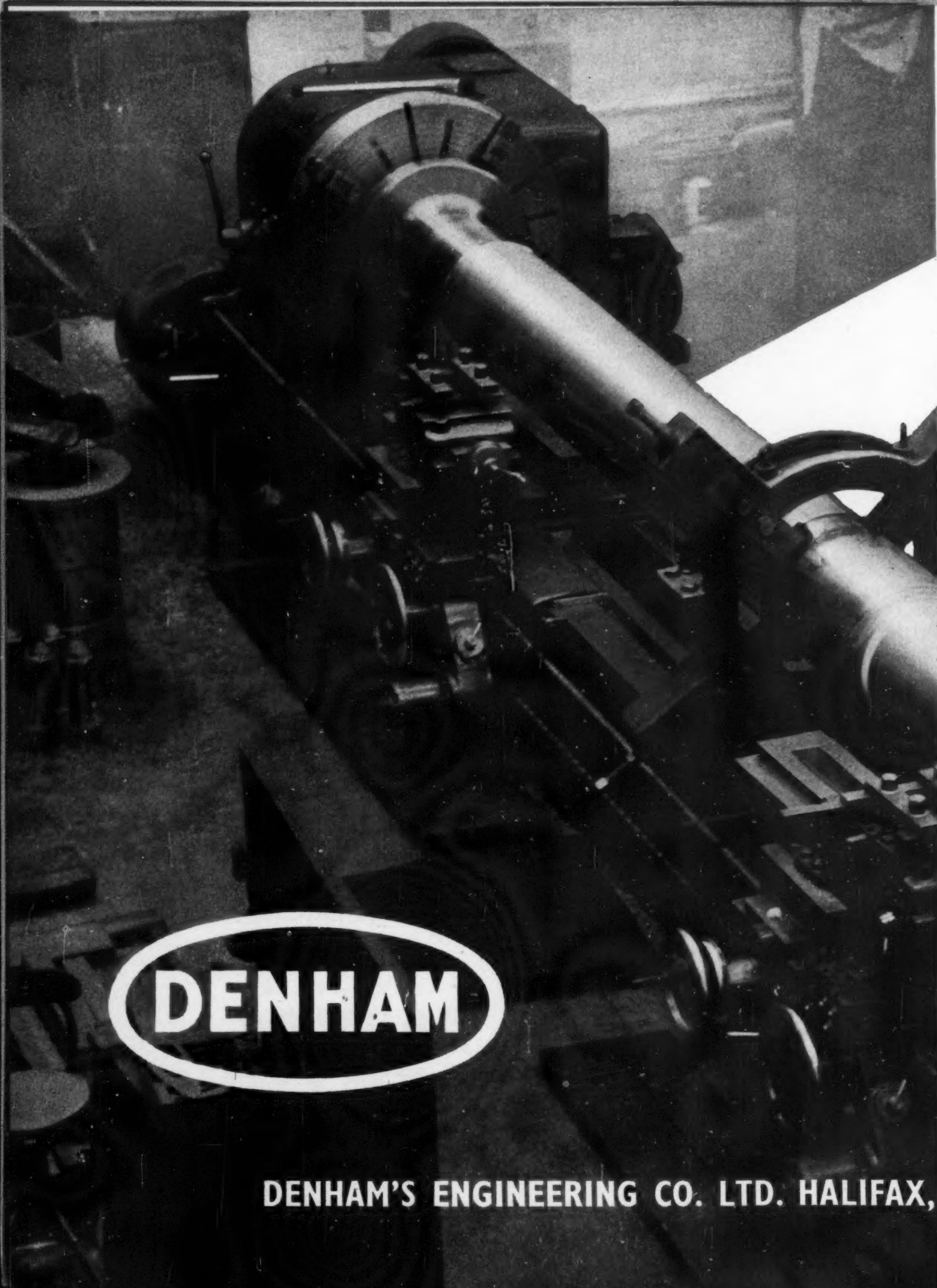
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# *Heavy Duty* LATHES

**high speed - high power - massive construction**

***in a range from 17 in. to 44 in. swing, including 17 in. and 25 in. swing.***

***Surfacing and Boring lathes.***

The $20\frac{3}{4}$ in. centre machine illustrated—admitting 32 feet between centres—is shown finish turning the taper of a marine propeller shaft, using the 30 in. stroke of its power operated tool slide.


Photo by courtesy of
The Sunderland Forge & Eng'g.
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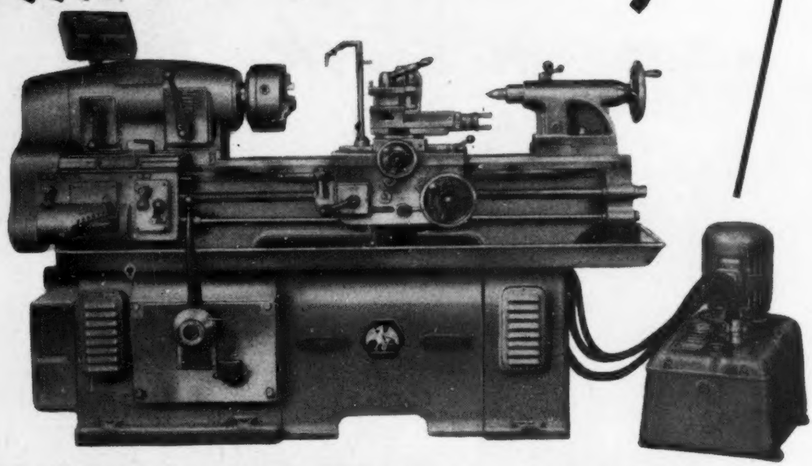



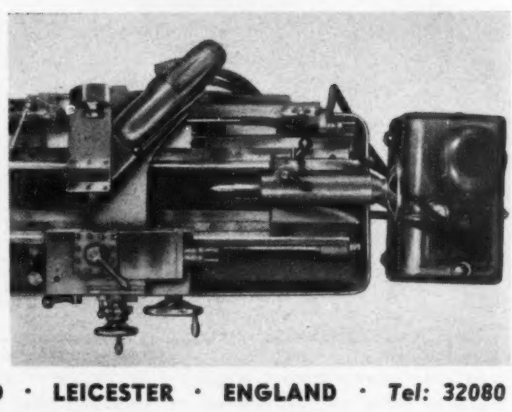

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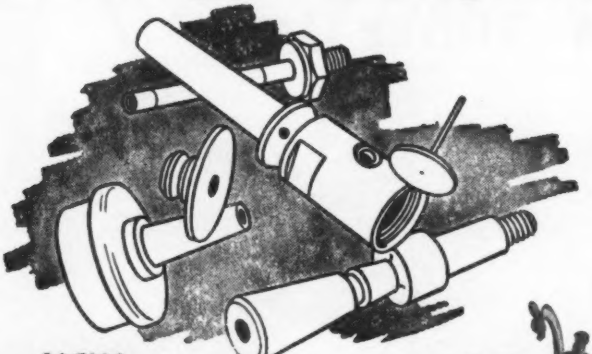

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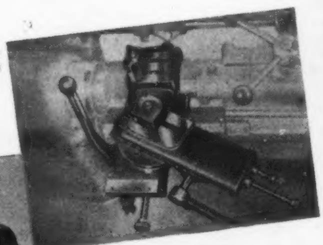
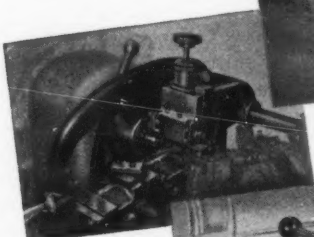
### SECOND OPERATION LATHE

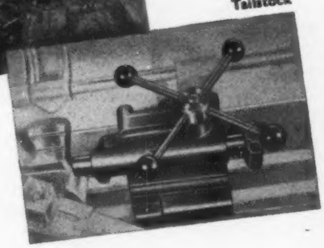
Compound Slide



Thread Chasing Attachment



Drilling and Boring Tailstock



**With 4" turning length and lever operated compound slide swivelling up to 45° for taper turning, this machine is unusually sensitive and versatile. Work up to nearly 3" dia. can be handled. The collet is lever operated (air operated collet extra) and the drilling and boring tailstock is provided with drill extractor. Eight spindle speeds 75–3000 r.p.m. or alternative higher speeds are available, a single lever selecting High or Low speeds, both Forward and Reverse.**

**Many useful items of equipment are available, such as thread chasing, and alternative methods of work holding.**

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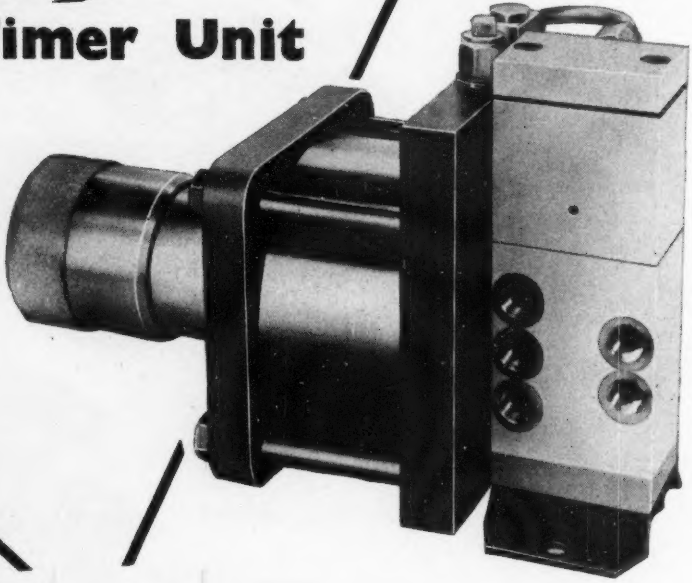
# Martonair

## Process Timer Unit



The Martonair Process Timer Unit is an accurate, reliable and rugged timer, incorporating a 5-port valve. There are only two moving parts; the unit will withstand considerable abuse and can be installed in wet, damp or dusty situations and can safely be used in inflammable atmospheres.

The 5-port valve may be reset by manual, pneumatic or electrical means and after the preset interval returns to its original position.

The principal of operation is that of a fixed orifice charging a variable volume reservoir. This gives proportional timing, the valve being operated after a predetermined pressure has been built up. The arrangement is such that quite large variations in air pressure (viz. ± 10 p.s.i.) have no appreciable effect on the accuracy of the timing.

| | | | |
|---|---|---|---|
| TYPES | S.812/1 | ¼" B.S.P. | Process Timer Unit with manual reset. |
| | S.812/2 | ¼" B.S.P. | Process Timer Unit with air reset. |
| | S.812/22 | ¼" B.S.P. | Process Timer Unit with solenoid actuated reset. |
| | S.813/1 | ½" B.S.P. | Process Timer Unit with manual reset. |
| | S.813/2 | ½" B.S.P. | Process Timer Unit with air reset. |
| | S.813/22 | ½" B.S.P. | Process Timer Unit with solenoid actuated reset. |

RANGES 5 —60 seconds.
30 —90 seconds.
1½— 2½ minutes.
2½— 3½ minutes.
3½— 4½ minutes.

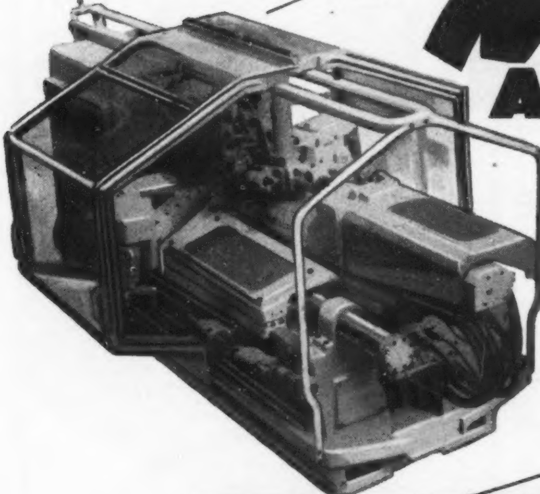
ACCURACY ± 1%

OPERATING PRESSURE 80 p.s.i.

***Each type of process timer is available in the ranges stated. The calibration is made at 80 p.s.i., but the Timers may be operated at higher or lower pressures.***

**MARTONAIR LIMITED, PARKSHOT, RICHMOND, SURREY**

A.D.14



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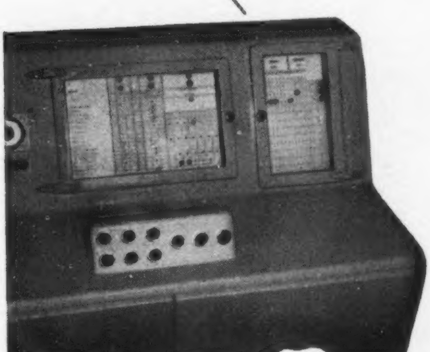
# CODICOP

This new machine means not only greatly increased production but also big savings in floor space and overheads. One CODICOP will carry out the work of several standard type turret lathes and will show outstanding results on small and medium, as well as large batches.



- INCREASES OUTPUT BY UP TO 300% ON SMALL OR LARGE BATCHES
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- PUNCHED CARD RECORD ENABLES ANY SEQUENCE OF OPERATION TO BE REPEATED AT WILL

**CAPACITY**

| | |
|---|---|
| Height of centres | 11" |
| Distance between centres | 23½" |
| Maximum swing in front of faceplate | 24½" |
| Spindle bore | 3⅞" or 8" |
| Spindle speeds | up to 750 r.p.m. |
| Main motor | 40 h.p. |

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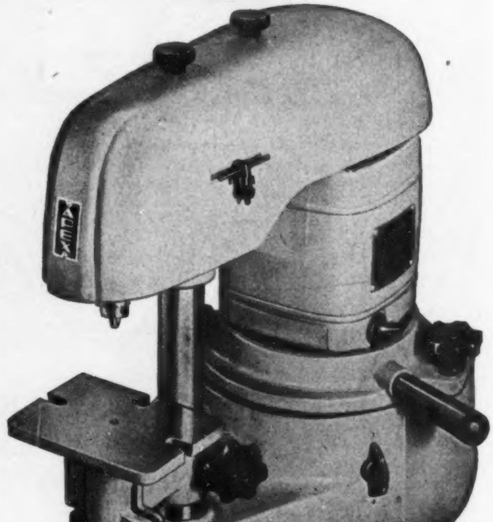
**14 B.A. to 2 B.A. in steel.**

The design of this machine is based on many years' experience of tapping small holes, combining speed of operation with maximum tap life. Simplicity and rigidity of construction ensure trouble-free working. The spindle is light, carrying no clutches or other mechanism and being rotated by a friction cone drive.

**Both these machines have special quick-action table movement for fast production, plus robust construction. They are supplied complete with ¼ h.p. motor.**

Chuck Guards are now available for both machines



## *Junior* SENSITIVE DRILLING MACHINE

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This robustly constructed machine has been specially designed to produce accurate holes from 0·010in. to 0·250in. diameter, meeting the exacting requirements of the horological and instrument trades; it is equally suitable, however, for the general engineering workshop where accuracy and speed are the main considerations.

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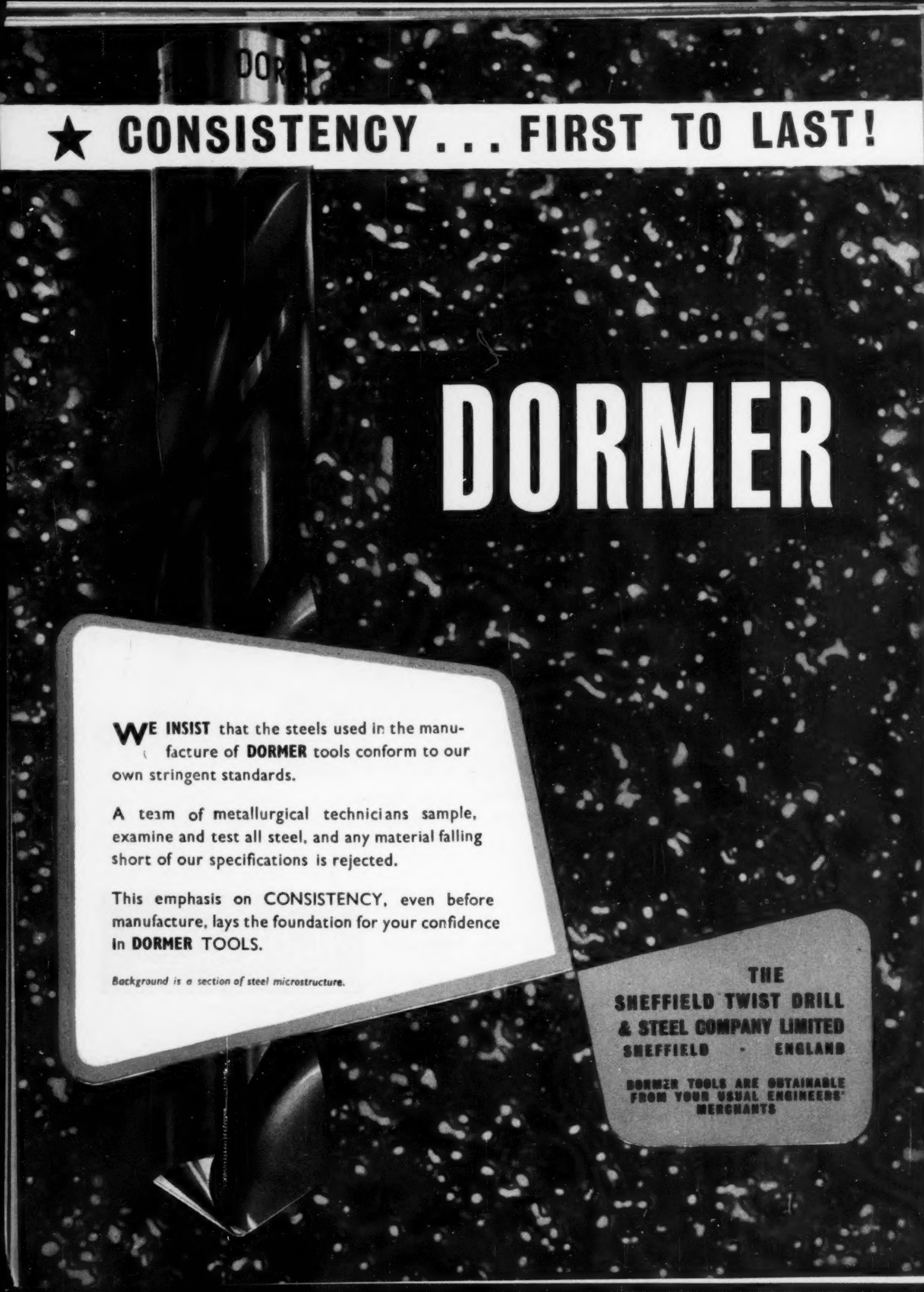
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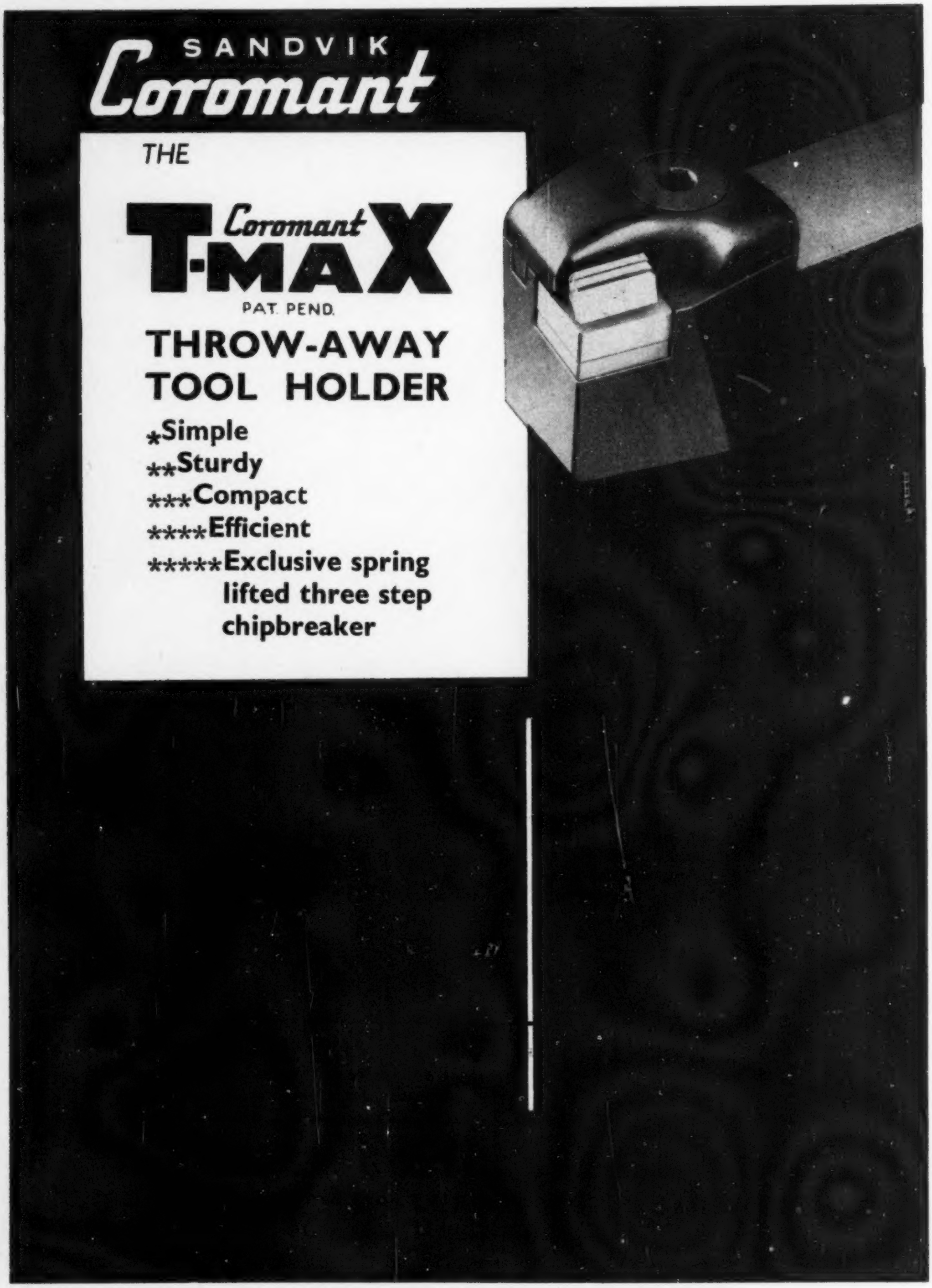
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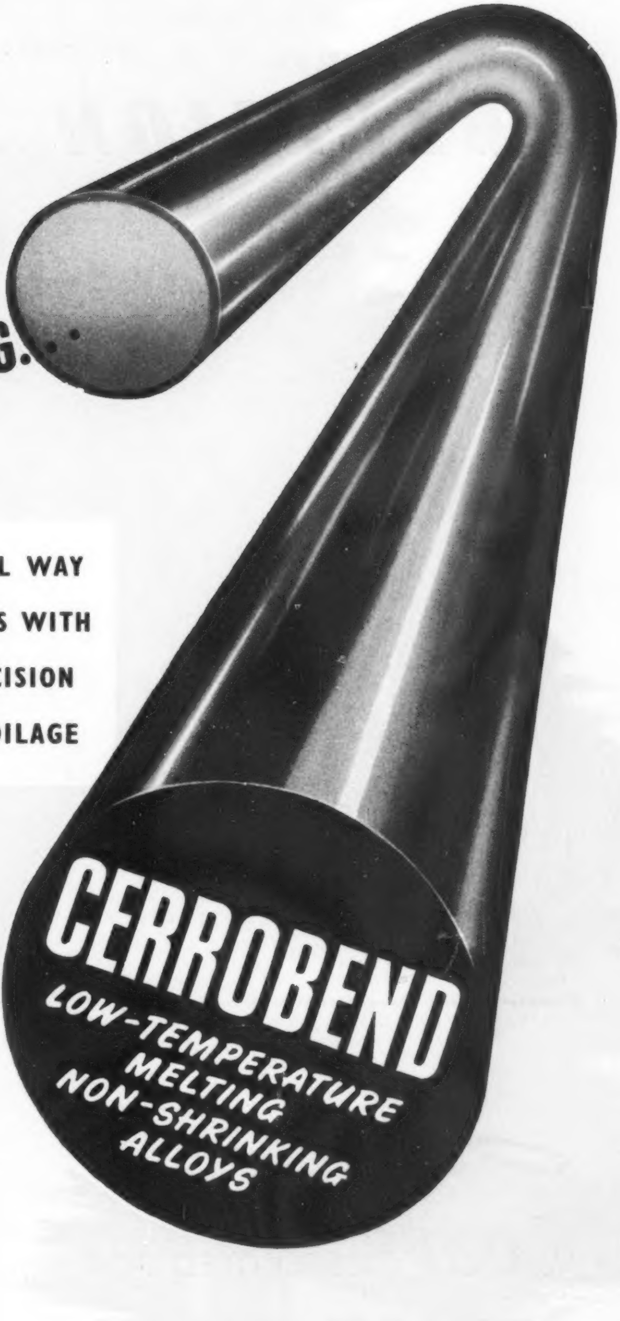


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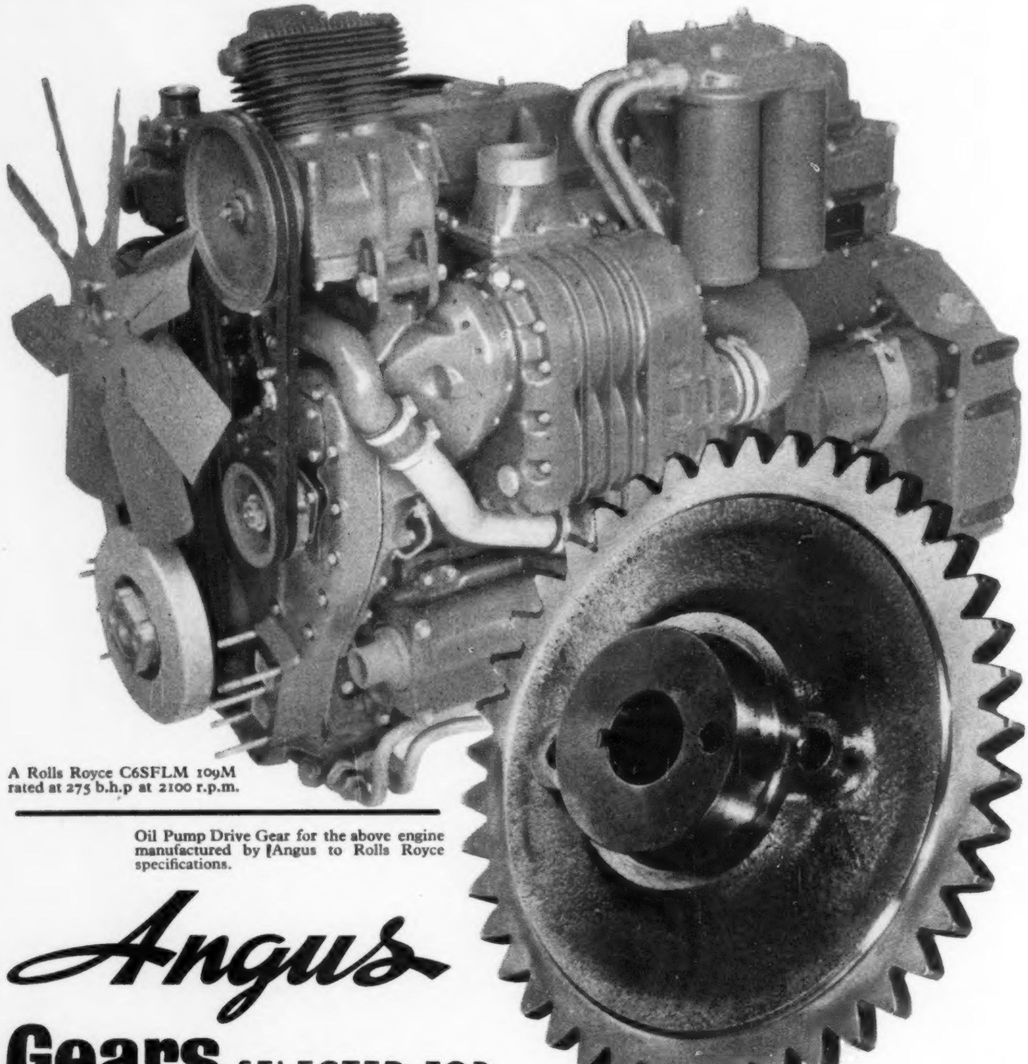

A Rolls Royce C6SFLM 109M rated at 275 b.h.p at 2100 r.p.m.

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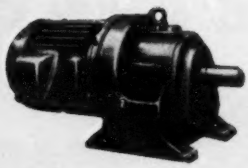
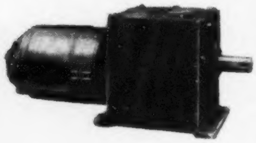
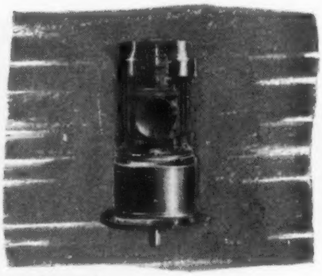
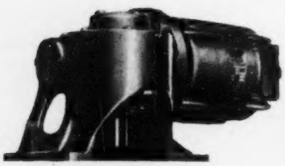
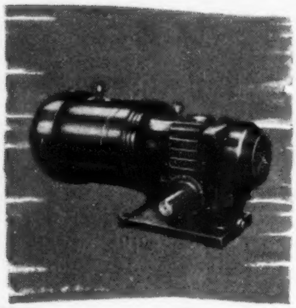

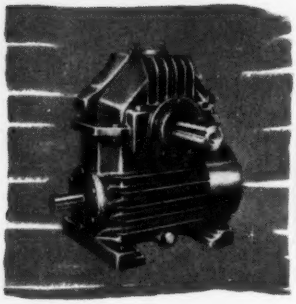
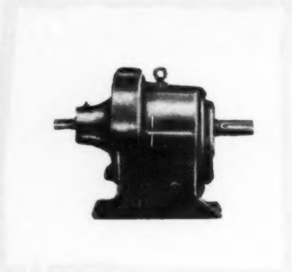
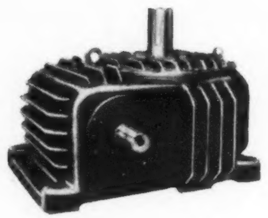

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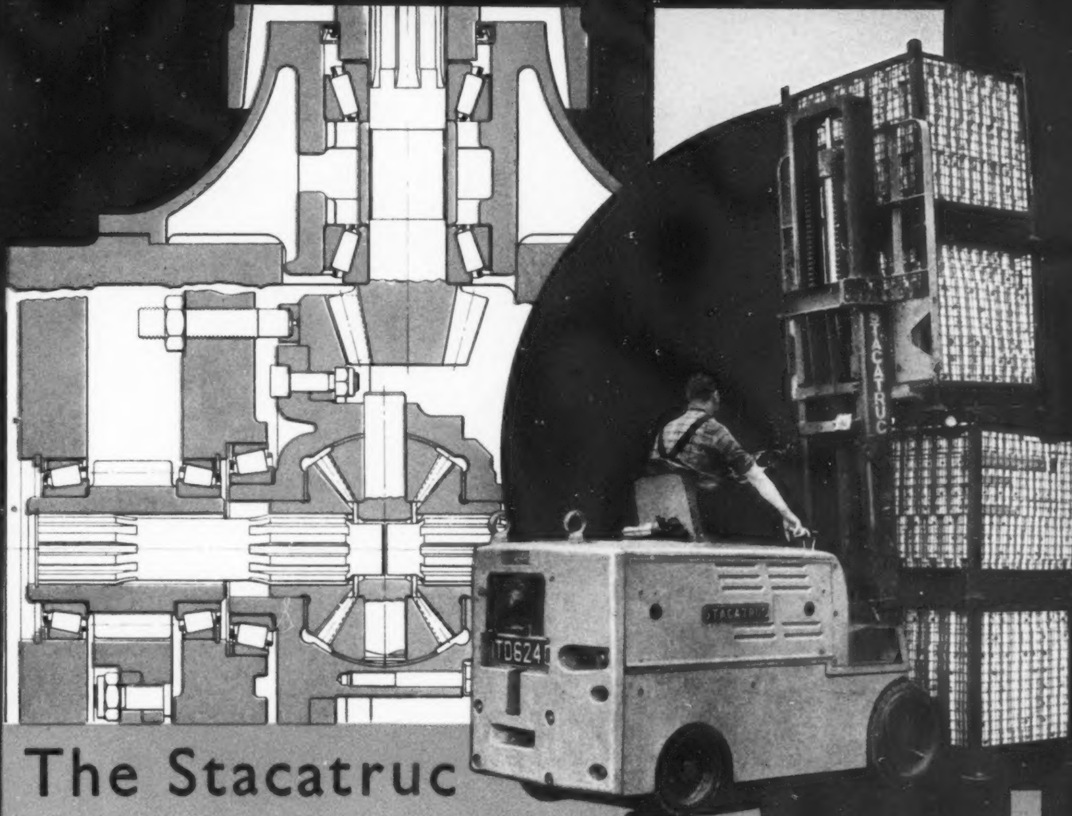
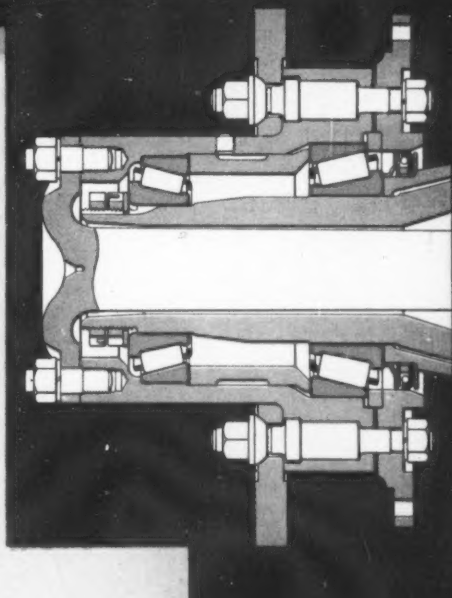



# The Stacatruc

Made by I.T.D. Ltd. of Birmingham, the Stacatruc 624D is widely used in industry.

The sectional drawings of the transmission and wheel bearings show the practice followed, with heavy-type differential gear and full-floating driving shafts to hubs carried direct on the axle casing. The drawings show the arrangement of the Timken bearings.



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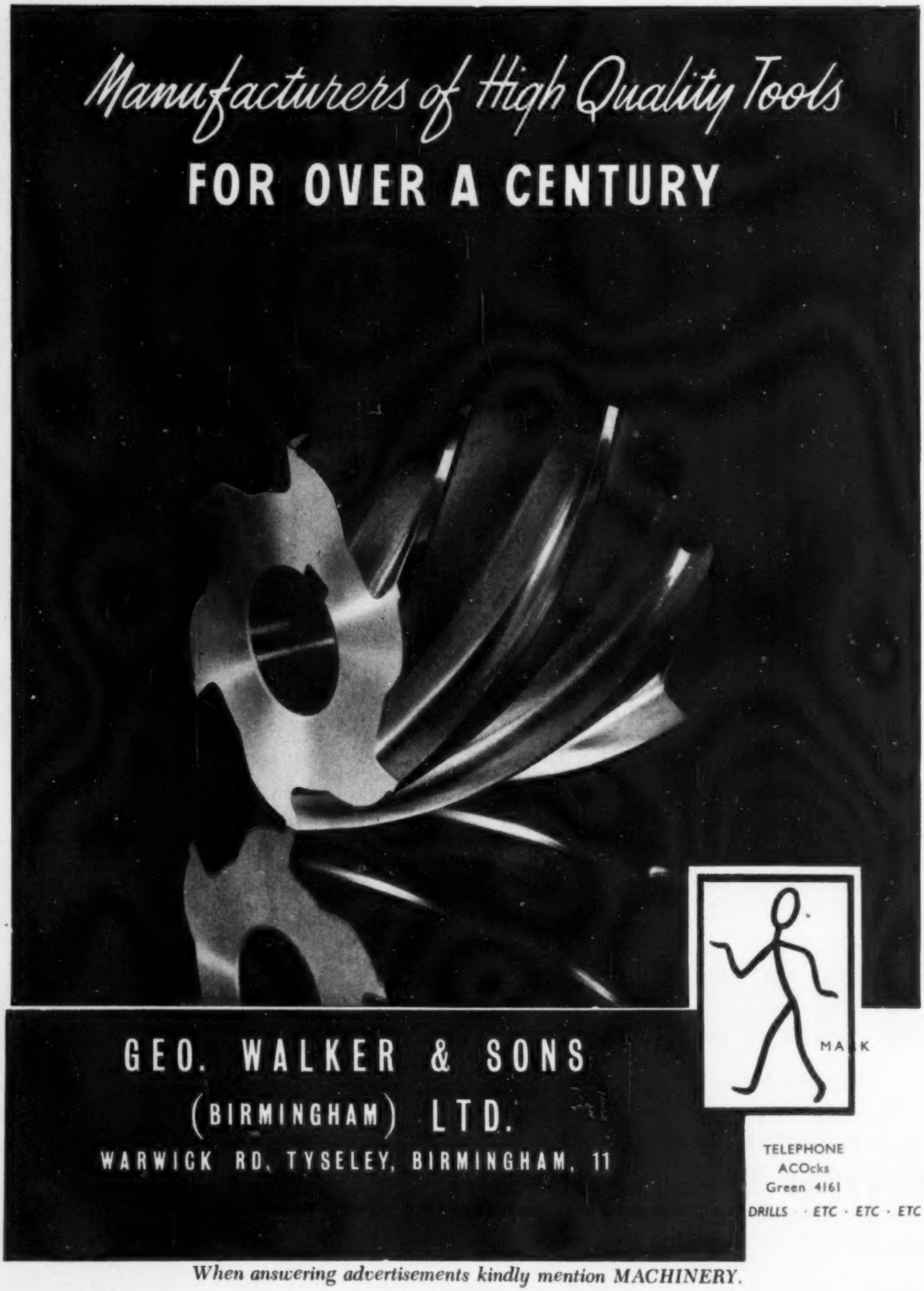
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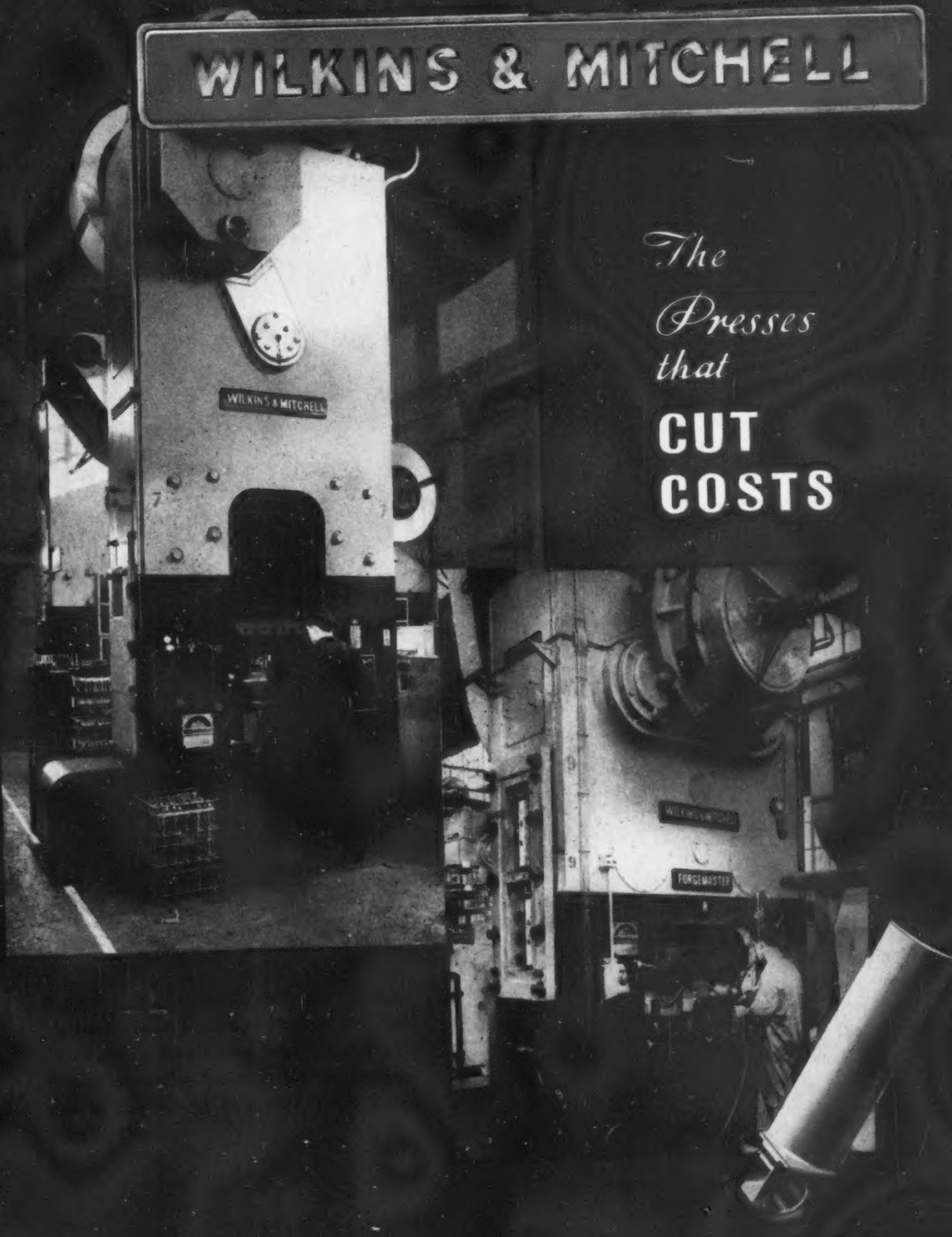
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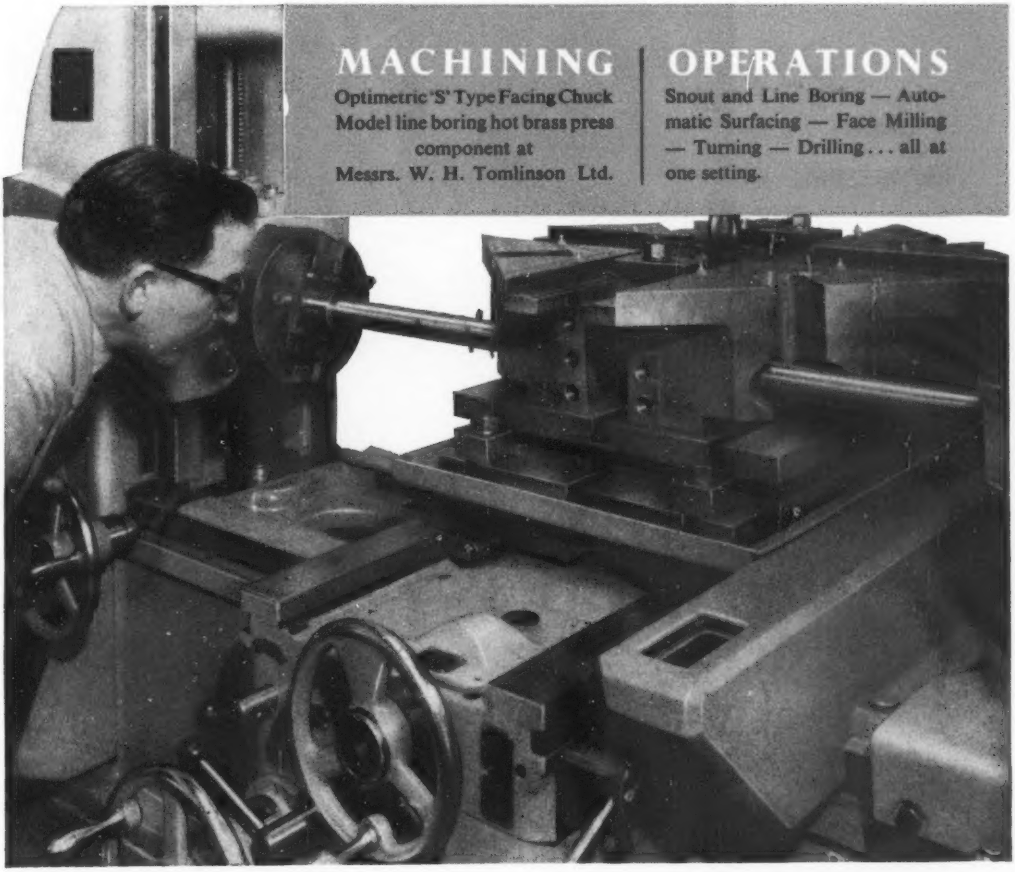


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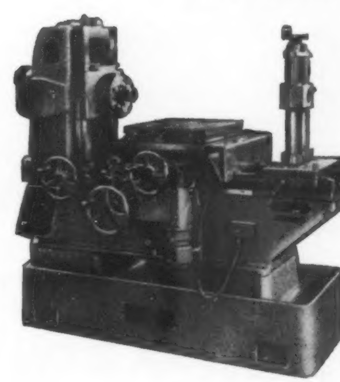

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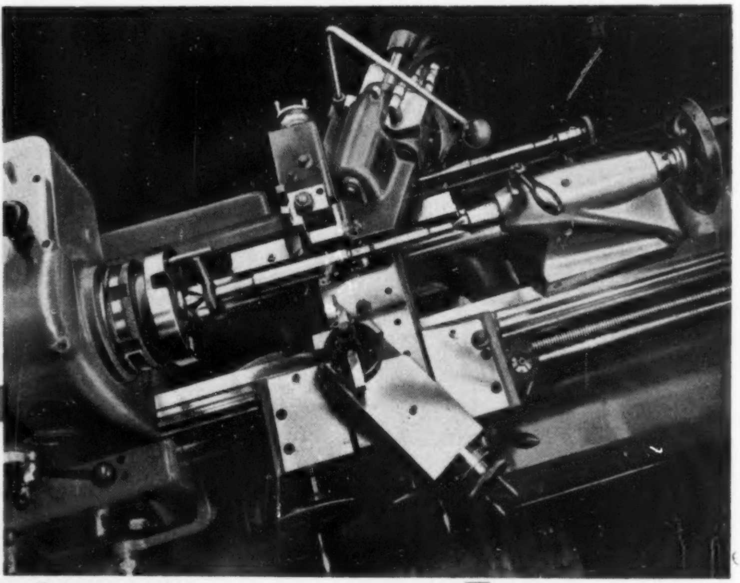
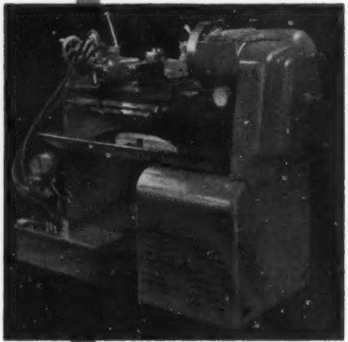




# APL greases passed

TRIUMPHS OF SHELL RESEARCH...2

# their finals in June...

Radiation broke up the gel structure of conventional greases. They lost their lubricating properties, turned fluid or granulated. Completely new kinds of greases were needed by the atomic power industry for the bearings situated within the radiation field.

The Shell Group started working out radiation-resistant APL greases whilst most nuclear power stations were still on the drawing-board, and the research that went into them is characteristic of the way Shell set about doing things.

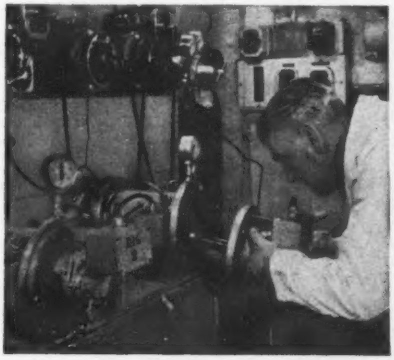
A team of research workers was assembled at Shell's Research Centre at Thornton. After four years of research and testing – both at Thornton and the A.E.R.E. Harwell – APL greases were ready for their finals. A sample was packed into a bearing and sunk into the B.E.P.O. pile. There it was not only subjected to mechanical working and high temperatures in $CO_2$, but also to an integrated pile dosage of $2.7 \times 10^{18}$ thermal N. per sq. cm. plus associated radiation. APL greases sailed through their finals – and Shell are proud of it. They should be. For with these greases, Shell completed Britain's first range of Atomic Power Lubricants.

The moral of the APL story is that Shell research is supremely applicational. The Centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right lubricant for the job. If you and your organisation have any major lubrication problem, it will pay you to get in touch with your local distributor of Shell Industrial Lubricants.

## The Research Story

Naturally a whole variety of greases were investigated. Conventional metallic soap greases were affected even by relatively low levels of radiation. Other greases based on synthetic and non-petroleum materials were examined and found to be equally unstable. Some of them softened appreciably and became tacky, whilst others hardened.

The Shell APL 700 series of greases are specially processed with an inorganic gelling agent, the base lubricant used being similar to the APL oils previously proved highly resistant to radiation. There were three series of tests. First tests were preliminary radiation tests at Harwell. Then the greases were tested for their lubricating qualities in a high temperature (400°F) pressurised $CO_2$ anti-friction bearing rig turning at 1,500 r.p.m. For the final tests in June, actual working conditions were simulated at Harwell.



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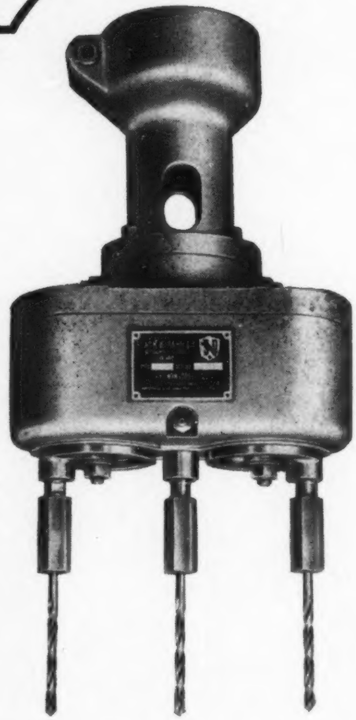

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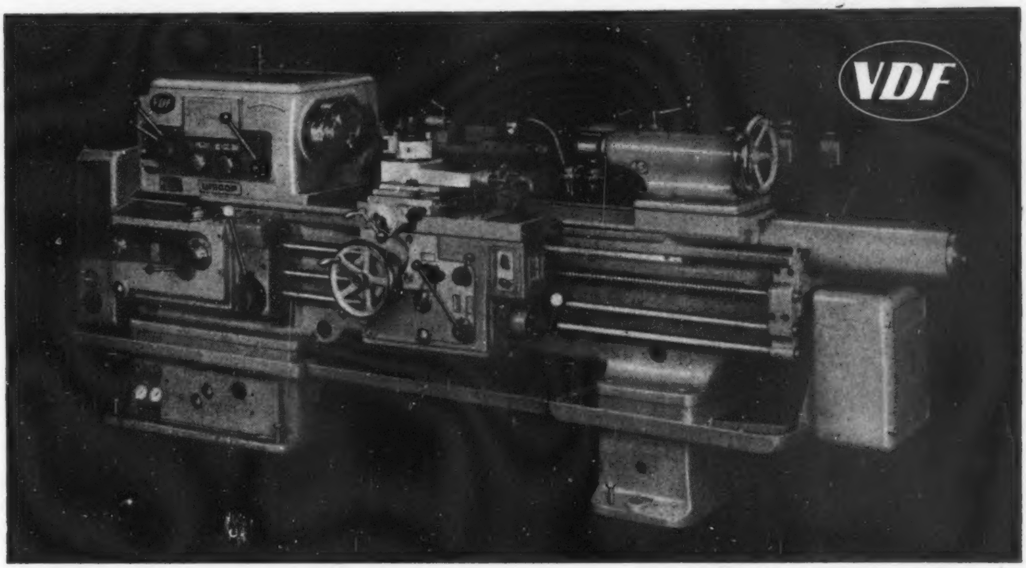
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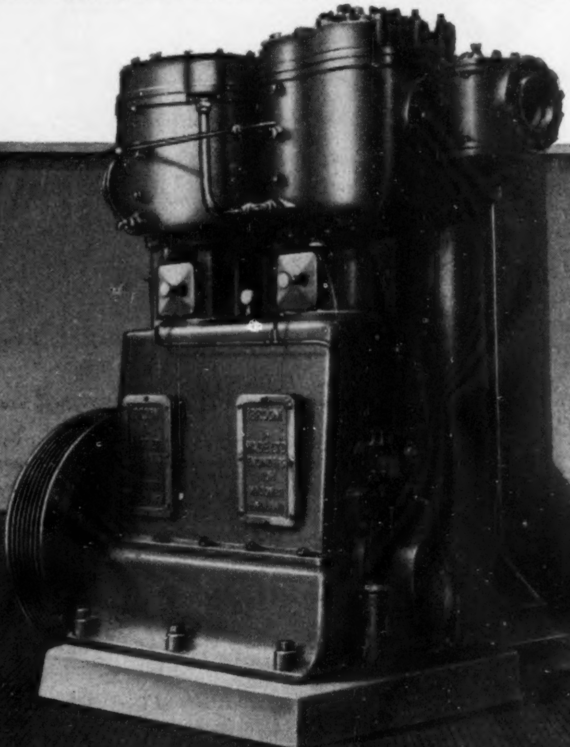

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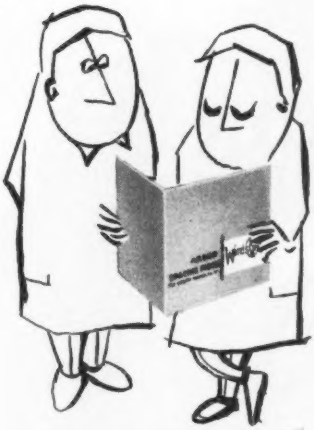


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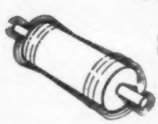

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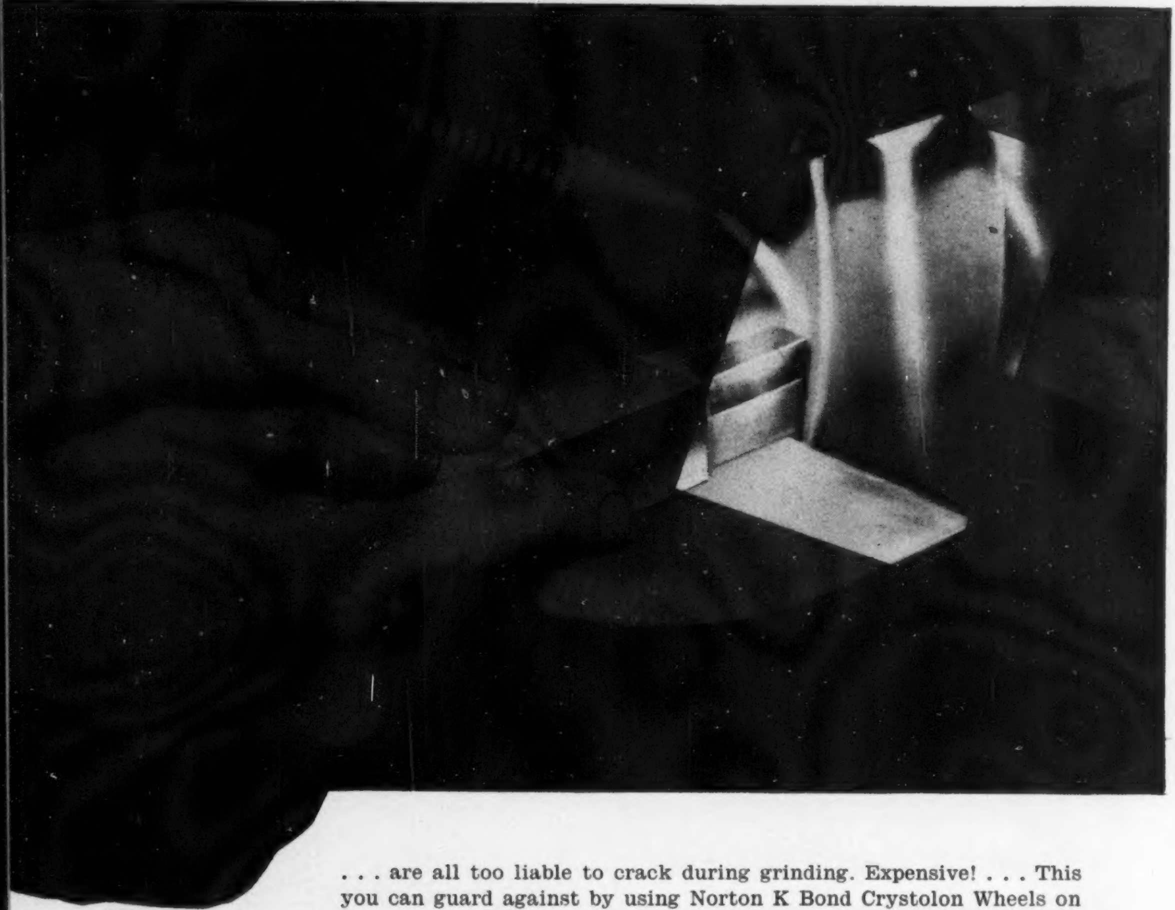

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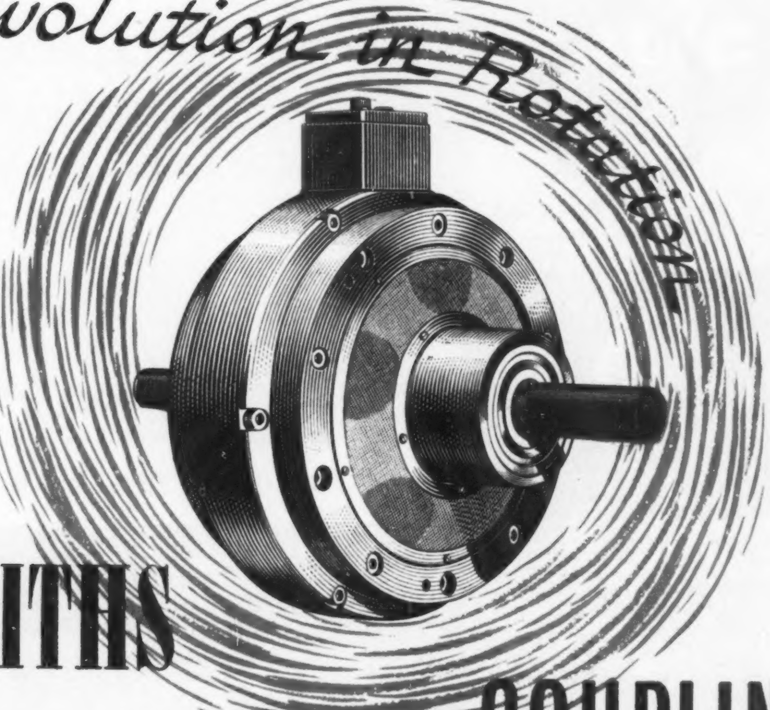

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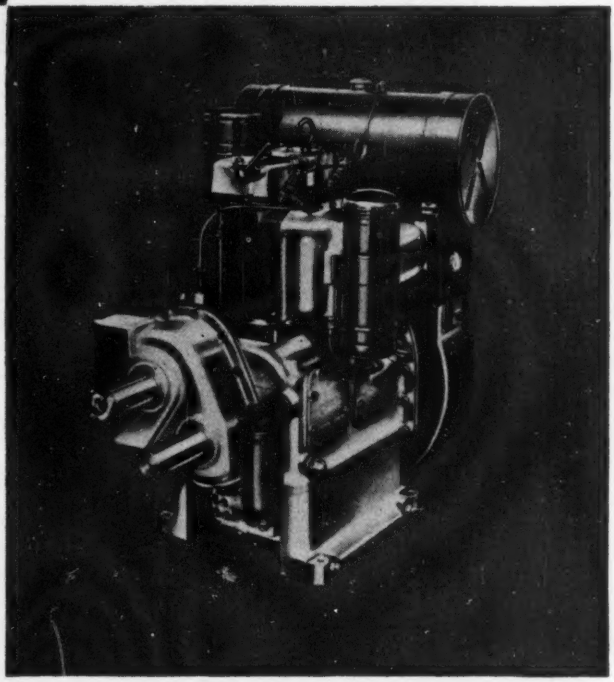

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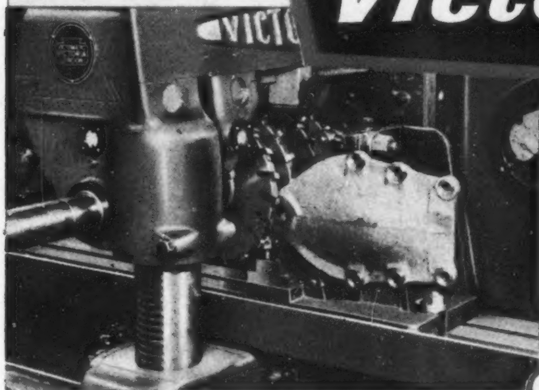

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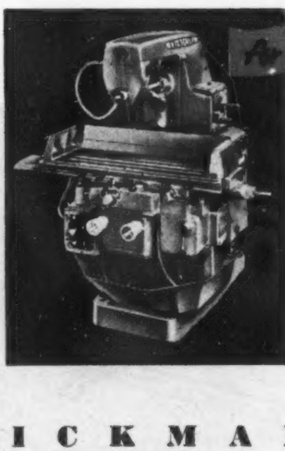

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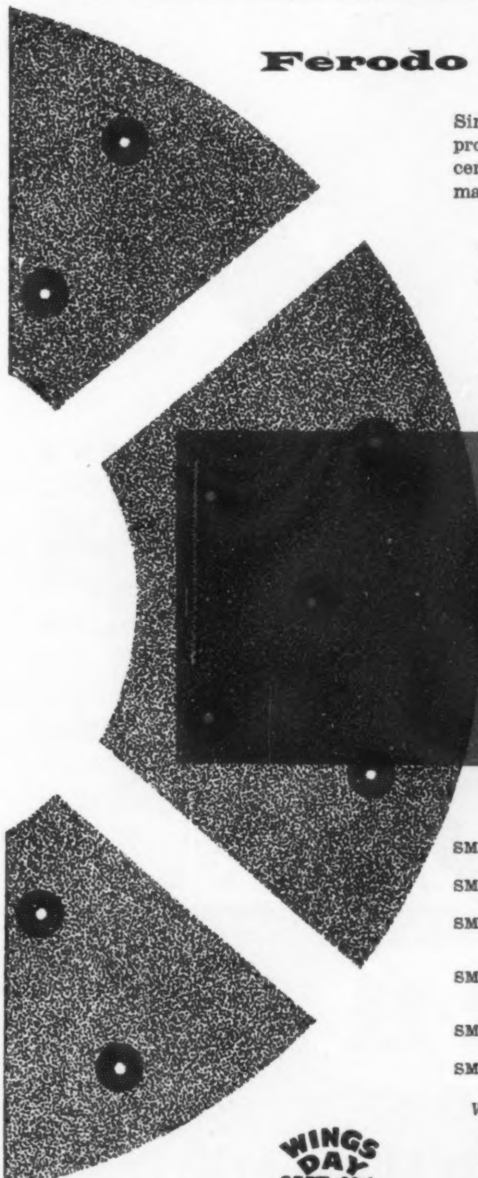

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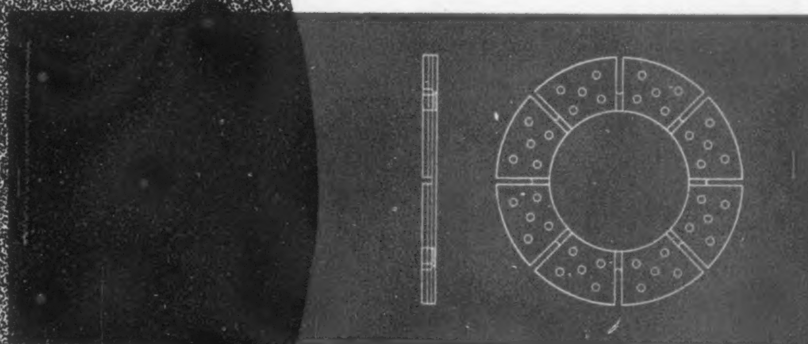

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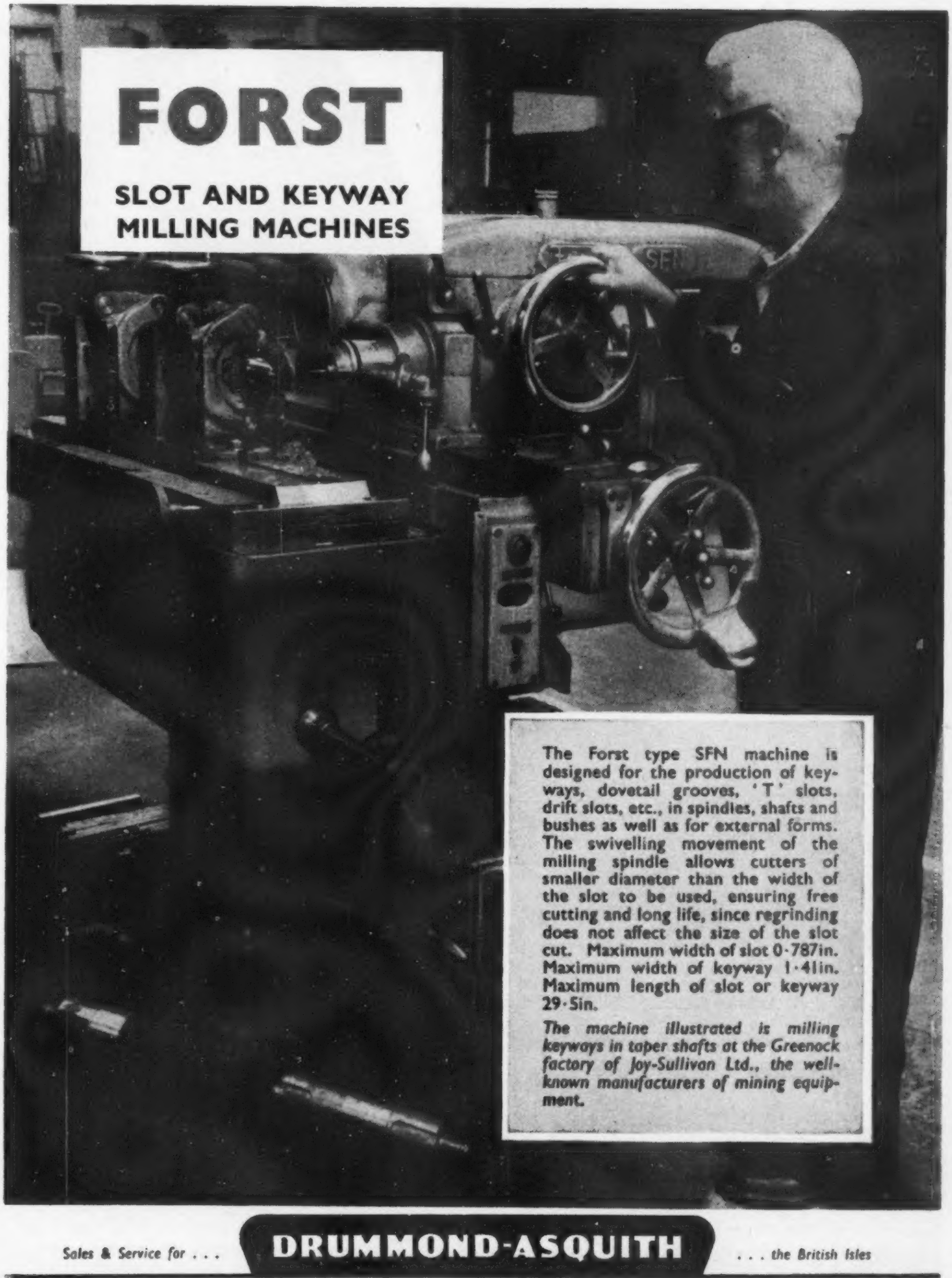

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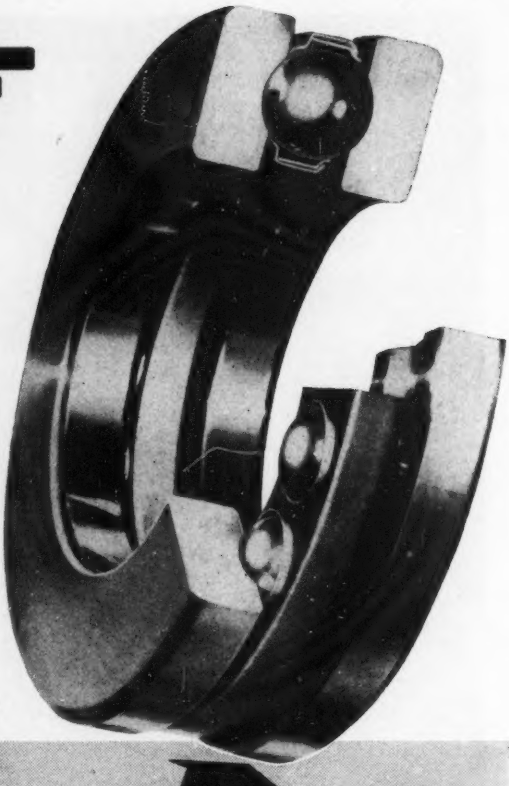

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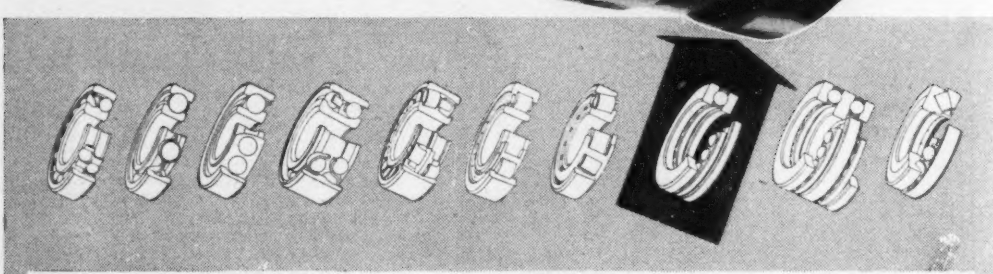

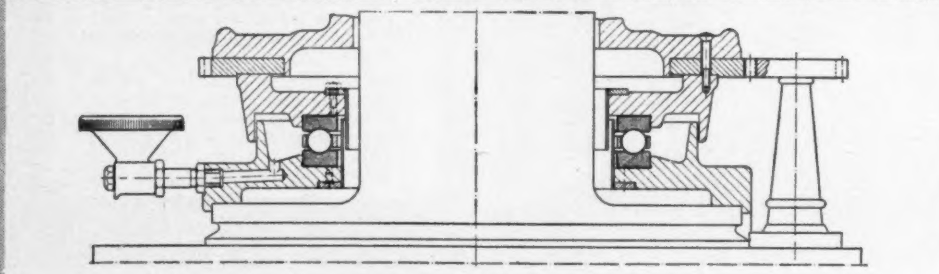

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# MACHINERY

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## CONTENTS



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# Abstracts of Principal Articles

## The Production of Automatic Transmissions for Motor Cars ..........................P. 632

This third article in a series describing the production methods employed by Borg-Warner, Ltd., in their Letchworth factory, for the manufacture of automatic transmissions, deals with the series of operations required on the mainshaft. Shaft blanks prepared by a cold-forming process, so that they are of the approximate dimensions specified, and require the minimum of metal removal, are employed, and after being milled to overall length and centre-drilled, they are turned on two automatic lathes. Carbide-tipped gun-drills are then employed on a special 5-spindle machine for drilling a long bore of small diameter, into which a valve is subsequently fitted, and another special machine performs finishing operations on the outer ends of this bore. After various oil-transfer holes have been drilled, the edges are ball-peened, and the shafts are then surface-hardened, in two fixtures, on a 50-kW. induction heating unit. Tempering is followed by hobbing the splines on an 8-spindle machine, and another special machine is then employed to finish-grind three O-ring seal grooves. The ends of one set of splines are de-burred on a special unit before the bore is honed to the required limits, and the thread at one end of the shaft is finally milled on a planetary-type machine. (MACHINERY, 93—17/9/58.)

## Wade Furnaces for Brazing Stainless Steel and Heat-treating Jet Pipe Assemblies P. 645

One of the furnaces described here is of the horizontal conveyor type and is intended for brazing stainless steel and Nimonic parts. For this purpose, a controlled atmosphere of exceptional dryness is required and the installation includes an ammonia cracking plant and towers for moisture removal. The other furnace, of the vertical pit type, with an internal diameter of 8 ft. and a height of 21 ft., was designed for hardening and solution annealing operations on jet pipe assemblies. For this vertical furnace, a forced air circulation system is provided, which can be disconnected when work is to be solution annealed at temperatures within the range from 1,100 to 1,200 deg. C. (MACHINERY, 93—17/9/58.)

## Vinyl-metal Laminates ..................P. 649

Sheet metal covered with a layer of vinyl plastics is available for a variety of purposes. The backing metal may be steel, aluminium, or magnesium, with thicknesses ranging, for example, from 0·015 to 0·060 in. Vinyl layers with a diversity of finishes can be provided, and are normally from 0·004 to 0·020 in. thick. Such laminated material can be deep-drawn, sheared, crimped, bent, punched, and drilled, without damaging the bond or the vinyl surface, and is claimed to offer important advantages for numerous applications. The method of preparing the backing material and bonding the vinyl coating is here described, and the techniques and precautions necessary for successful pressing are considered. Attention is also drawn to the possibilities of welding brackets or hinges to the metal backing without destroying the coating. With the special equipment developed for this purpose, the welding force is applied magnetically. (MACHINERY, 93—17/9/58.)

## Continuous-casting of Tough Pitch Copper Slabs .......................................P. 659

A continuous-casting plant has been installed at the Perth Amboy works of the American Smelting & Refining Co., N.J., U.S.A., whereby tough pitch copper slabs up to 25 ft. long by 36 in. wide by 5 in. thick can be cast at the rate of 20 in. per min. To prevent the metal sticking to the surfaces of the orifice during casting, the mould is continuously-reciprocated at several hundred cycles per min. A 27-ft. stroke stainless-steel ram is employed to support the weight of the slab, as it is lowered into the water-filled cooling pit. (MACHINERY, 93—17/9/58.)

## Robinson Automated Machine for Trimming, Adzing and Boring Railway Sleepers ...................................P. 661

On this machine sleepers are handled at the rate of 10 or 6 per min. depending on whether the wood is soft or hard. There are in-feed and out-feed chain conveyors, and provision can be made for trimming the sleepers to length by means of a circular saw as they pass along the in-feed conveyor. At the adzing and boring stations, each sleeper is supported on separate, flexible bed sections, with independent rise and fall, to allow for warping or other irregularities. These bed sections are controlled by counterbalance weights, through plungers. For feeding the sleepers under the adzing and boring heads, reciprocating hinged dogs are provided. A small motor can be mounted between the adzing heads to drive one or more saws for making the sleepers with a pattern of grooves. Reference is also made to a timber incisor which prepares the surfaces for treatment with liquid preservative and reduces surface tension. (MACHINERY, 93—17/9/58.)

## Thread and Form Rolling...............P. 673

The paper, an abstract of which is published here, was presented at the conference on Technology of Engineering Manufacture organized by the Institution of Mechanical Engineers. In an introductory section attention is drawn to the important advances that have been made in this field as a result of the development of materials with improved forming properties, and advances in the design and construction of thread rolling machines. Determination of blank diameter and the effects of roll diameter are then briefly discussed. Among the applications of the technique which are considered may be mentioned the rolling of worm gears, splines, and knurled surfaces, also burnishing and straightening operations. In addition, there are sections concerned with planetary thread rolling machines, multi-operation machines, and thread rolling die heads. (MACHINERY, 93—17/9/58.)

# Automatic Control for Tool-room Work

To enable a wide variety of metal products to be manufactured economically, in large quantities, it is becoming necessary to provide increasingly elaborate tooling equipment. In consequence, both the time and cost of preparation, when a new design is to be introduced, are tending to rise, and although the outlay may be speedily recovered by reason of the high rates of output and savings in direct labour that are achieved, any means whereby tool-room work can be carried out more rapidly and economically is assuming growing importance. Some two years ago, attention was drawn in MACHINERY to the advantages that might result from the wider adoption of automatic control in this field, and with further developments, both in control systems and machines for their effective application, the potentialities are constantly extending. Such machines and control installations are necessarily expensive, and whereas they have already proved their worth for operations on elaborate components which are required in comparatively small quantities, for example in the aircraft industry, in many instances their value may be principally in the facilities which they afford for the provision of better and cheaper tooling.

One of the most important tool-room machines is the jig borer, and systems whereby automatic positioning can be obtained on such machines, to the necessarily close limits of accuracy, are already well established. In at least one instance, moreover, development has progressed considerably further, and a machine has been arranged to operate on a completely automatic cycle which, in addition to work table positioning, provides for selection of spindle speeds and feeds, changing of cutting tools at various stages, adjustment of spindle head for height, and control of the depth of bored holes. This particular installation is employed for limited quantity production of a precision component, but similar arrangements may well be justified for elaborate sequences of operations on single tools. It may, indeed, prove practical to set up a machine in this manner and leave it to function entirely un-tended during a considerable part of a night shift. Such intensive utilization would, of course, be an important factor in enabling the high initial cost to be quickly recovered.

Where provision is made for continuous control of tool position, to permit of machining irregular 2- and 3-dimensional forms, the possibilities may be even more attractive. It was reported by Mr. D. H. Bingham and Mr. R. G. Chamberlain, in a paper presented at this year's annual meeting of the American Society of Tool Engineers, that in one instance a large number of templates for use on aircraft spar milling machines was produced at a cost which was only 40 per cent of the price quoted in the next lowest competitive tender. In addition, it is stated, the time required to execute the work was only one-quarter of that which would have been needed for conventional methods. It may also be noted that one supplier of templates has indicated that, with automatic control, it has been possible to reduce errors to one-quarter of the former values.

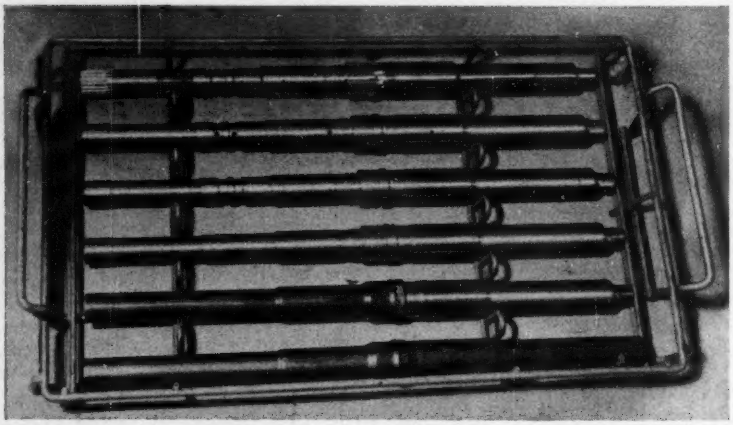
Comparative details were given by the authors for a particular template, and it was shown that of the total time of 8·6 hours required with conventional methods, 4 hours was occupied in profile scribing, and 4 hours in finish filing. For automatic control, the preparatory stages, which comprised programming, key punching, computer operation, and conversion of data to paper, and finally to magnetic tape, required 0·55 hours, and setting up and machining were completed in 0·3 hours. The total time was therefore 0·85 hours, or only about one-tenth of that needed for hand methods.

For a 3-dimensional form, such as a die cavity, the programming time necessary when machining is to be carried out with automatic control may be considerable, but the overall savings are nevertheless very substantial. Starting with a conventional die drawing on which the necessary allowances have been made, for example for metal shrinkage, the methods planner provides a methods drawing and methods sheet. It is then possible for the programmer to designate the tool path, and the resulting information is processed to obtain the magnetic tape. Copies of the planning sheet and the computer output "manuscript" are provided for the guidance of the machine operation.

As an example, the sinking of a small die cavity was considered in the paper, and it is indicated that of the total time of 96 hours needed with conventional methods, 8 hours were occupied in layout, 16 hours in the preparation of templates, 60 hours in machining, and 12 hours in bench finishing operations. When the cavity was

*(Continued on page 680)*

# The Production of Automatic Transmissions For Motor Cars



*Methods Employed by Borg-Warner Ltd., Letchworth, Herts.*

In the first of two previous articles in this series, published in MACHINERY, 92/1132—16/5/58, the design and operation of the Borg-Warner automatic transmission for motor cars were considered, and the factory which has recently been erected at Letchworth, Herts., for the production of automatic transmissions and over-drive units, was briefly described. The article was mainly concerned with the efficient methods employed for machining rear extension castings, and in a second, published in MACHINERY, 93/120—16/7/58, the production of the main casing for the automatic transmission was described. Here, the extensive series of operations involved in the manufacture of the mainshaft for this unit is discussed.

Some examples of mainshafts at various stages of completion are seen in the heading illustration, which also shows one of the special steel wire trays employed for transporting them in the factory. These trays are designed to prevent the shafts from rolling about and thus protect finished surfaces from damage, and the handles at the ends enable them to be stacked if necessary. A sectional view of the finished shaft is shown in, Fig. 1, and it will be seen that the component is of intricate shape, with three different sets of splines, numerous diameter steps, and a long central bore to accommodate a hydraulic valve in the final assembly. This valve is shrunk with liquid nitrogen before it is fitted.

As was explained in the first article of the series, many of the machine tools employed for the production of the mechanical parts of the transmission were transferred from the American factory where the units were originally produced.

The methods employed for mainshaft production were based on the availability of shaft blanks prepared by a cold reducing process, which have hitherto been imported from the U.S.A. Mainshaft forgings are now being produced by Smith-Clayton Forge, Ltd., Lincoln.

One of the prepared blanks is seen at the bottom in the heading illustration and it will be observed that it has been reduced at certain positions to diameters only slightly larger than those required on the finished shaft. The use of such cold-reduced blanks leads to important economies in material consumption and to a considerable reduction in machining time. Another advantage is the increased tensile strength obtained, which has enabled heat treatment to be confined to hardening operations at certain positions. In addition, the material hardness is increased from about 20 to between 28 and 32 Rockwell C.

### DAVIS & THOMPSON ROTARY MILLING MACHINE

At the first operation on the prepared blank for the mainshaft, the end surfaces are rough and finish milled flat and square with the shaft axis, and to the required overall length of 21⅞ in., on the Davis & Thompson rotary milling machine shown in Fig. 2. On this machine, a massive horizontal shaft A is driven continuously through a torque-controlled clutch by the 20-h.p. motor mounted above at the left-hand end, which also

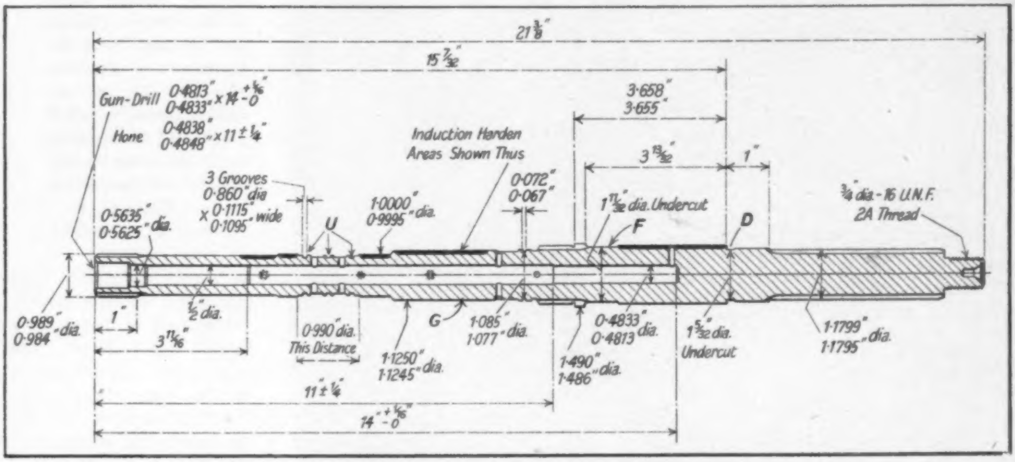



**Fig. 1. A Sectional View of the Mainshaft for the Borg-Warner Automatic Transmission, which has a Long Bore of Small Diameter for the Reception of a Valve**

drives four cutter spindles. The shaft is supported at each end in heavy-duty bearings and carries three drums, each with 16 V-slots in the periphery, to receive the work blanks. The sides of each V-slot are lined with hardened serrated pads and the drums are so spaced, and the slots so arranged, that each shaft is fully supported although the pads of each line of slots contact different diameters.

Opposite each drum on the shaft, there is a clamping unit which can be adjusted on vee and flat ways at the front and rear of the machine bed. Each clamping unit incorporates an endless link-type chain which is held in contact with about two thirds of the drum periphery and serves to hold the shafts as they pass the cutters. The chain passes over pulleys within the clamping unit, and tension is applied to the upper pulley, at the rear, to clamp the shafts in position, by means of a large spring and draw-bolt. As the drums turn with the shaft, the chains are carried round on their pulleys, and the shafts are automatically

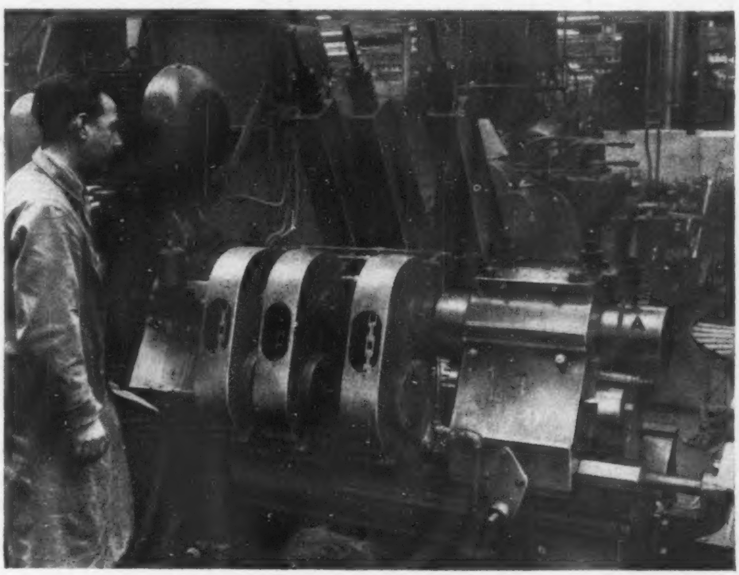


**Fig. 2. A General View of the Davis & Thompson Rotary Milling Machine for Rough- and Finish-milling Operations on the Shaft Ends. The Shafts are Carried Continuously Past the Cutters at Each End of the Central Carrier**

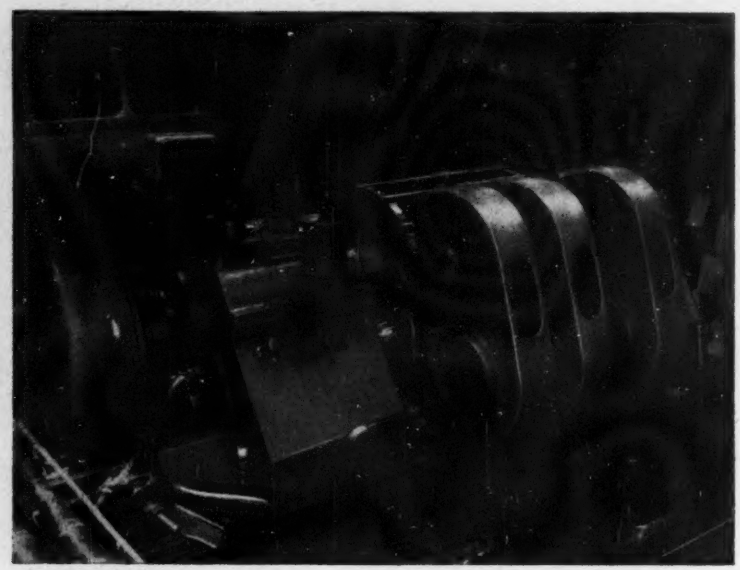


Fig. 3. Another View of the Davis & Thompson Machine, from the Operator's Position, Showing One of the Slotted Drums in which the Shafts are Held by the Action of the Spring-tensioned Continuous Chains

clamped and released as they pass from, and return to, the loading position at the top.

Another view of the machine, from approximately the position occupied by the operator in Fig. 2, is given in Fig. 3, where the left-hand drum is clearly seen. In each of the shaft housings, there are two cutter spindles, those in the right-hand housing being driven by a shaft which extends along the machine bed, and each spindle is fitted with a Wesson milling cutter of 6⅞ in. diameter, with 24 inserted carbide-tipped teeth. These cutters are driven at a speed of 48 r.p.m. and the drum-shaft turns through one revolution in about 12 min. giving a feed rate of approximately 8½ in. per min. From the loading position at the top, the shafts are carried downwards towards the rear of the machine, and they pass limit switches at each side. Should the shaft not be correctly located end-wise, against a stop provided on one of the drums, during the loading operation, or should a shaft be too long for presentation to the roughing cutters, one or both of these switches is operated, to stop the machine. At the roughing cut, up to ¼ in. of material is normally removed from each end of the shaft.

## SPECIAL DE-BURRING TOOL

As the shafts are removed from the milling machine they are de-burred by the operator with the aid of the special tool shown in Fig. 4, which is carried on the end of the worm-wheel shaft of a small reduction gear mounted on the bench. This shaft is driven at a speed of about 100 r.p.m. by a small motor at the rear. The design of the tool is clearly shown in the illustration, and the burrs generated during the milling operation are readily removed by pressing the end of the shaft against the cutting teeth on the cone-shaped surface. This operation requires only a few seconds for each end of the shaft, and the latter is then loaded into the next machine in the line, on which the ends are centre-drilled.

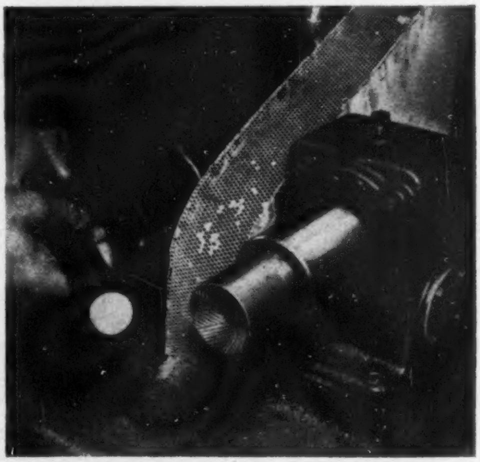


Fig. 4. After the Ends of the Shafts have been Milled, the Burrs are Removed by Pressing the Ends Successively into the Cone-shaped Rotary Cutter Shown, which is Driven by a Small Motor Through Reduction Gearing

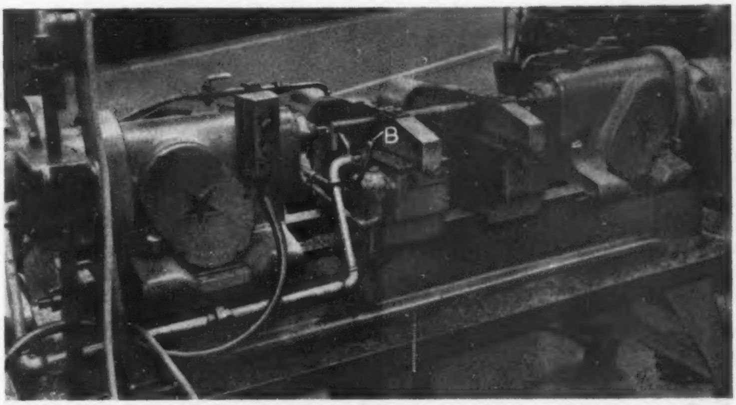



Fig. 5. The Shaft Ends are Centre Drilled, on this Machine, which is Fitted with Seneca Falls Unit Drill Heads and Linked Air-operated Clamping Jaws

### AUTOMATIC CENTRE-DRILLING MACHINE

Centre-drilling is performed on the C.M. Star automatic machine shown in Fig. 5, which has a long bed supporting a Seneca Falls (Gaston E. Marbaix, Ltd.) unit drill head at each end. The spindles of these heads, which are fitted with centre drills, are driven at 390 r.p.m. by motors of 1½ h.p., and are cam-fed towards the work when the cycle-start button is depressed. Between the heads, there are two clamping units for the mainshaft, which is loaded initially on V-surfaces and positioned end-wise by a stop at one end. The two jaws of each clamping unit are linked together so that they move inwards simultaneously to grip the component, and lift it slightly from the supporting V-surfaces. Each pair of jaws is operated by a separate air cylinder, and both cylinders are controlled by the valve *B*. All the machines employed for the operations so far described are tended by one man.

### OPERATIONS ON LO-SWING LATHES

For turning the mainshaft diameters, leaving small amounts of stock for finishing operations, two Seneca Falls Machine Co. (Gaston E. Marbaix, Ltd.), Lo-Swing type LR automatic lathes are employed. A general view of the first of these lathes, with the machines already mentioned in the background, is given in Fig. 6, and with this set-up the larger end of the shaft is turned, up to the shoulder near the centre. The shaft is loaded into an air-operated collet chuck, and is pushed up to a stop, which provides for end-wise positioning, before the live centre in the tailstock quill is advanced into engagement with the centre hole. Provision is made for turning the tailstock about a hinge point at the rear, to lift the front end clear for convenience in loading the work, by means of an air cylinder, and the quill is advanced and retracted by another cylinder. Both these cylinders are controlled by a valve *C*, at the rear of the tail-stock, operated, directionally, by means of a long ball-handled lever.

A single cross-slide is fitted at the rear of the machine bed, and is fed towards the work by a cam during the automatic cycle. The slide carries two inverted form tools which are employed to plunge-form a groove at the position *D*, Fig. 1, and to chamfer and face the shoulder adjacent to the portion to be threaded, also to chamfer the end of the shaft. The saddle at the front of the machine has two cross-slides, and the slide nearer to the tailstock carries a single tool to turn the end of the shaft to the required diameter for threading. One tool is mounted directly on the other slide and is employed to turn the shaft up to the groove *D*, Fig. 1. Both the slides are controlled by cams which move them in the longitudinal and transverse directions.

A second tool on the cross-slide nearer to the chuck is carried on an auxiliary slide, and its transverse movements are controlled by a cam surface on the under-side of the plate *E*, which is anchored by a tie rod to a bracket at the tailstock end of the bed. This tool is employed to produce the two diameters to the left of the groove *D*, Fig. 1, and during the first part of the travel of the slide, it follows a path parallel to the shaft axis. Towards the end of the traverse, the tool is fed in slightly, to produce the reduced diameter *F*, Fig. 1, adjacent to the chuck. A roller on the slide which carries this tool is held in contact with the cam surface by a strong coil spring. Apart from the form tools at the rear, inserted carbide tool bits of square and triangular form, with chip-breaker grooves in their top faces, are employed for this

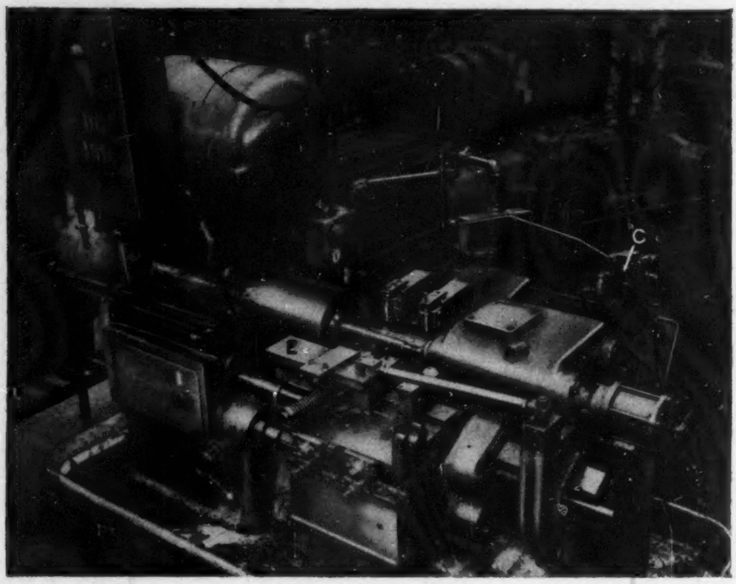



**Fig. 6. General View of the Lo-Swing Automatic Lathe Employed for the Initial Rough-turning Operation on the Larger-diameter End of the Shaft at the Right-hand Side in Fig. 1**

set-up, and the coolant is Anti-Sep (Edgar Vaughan & Co., Ltd.) soluble oil.

With a spindle speed of 1,200 r.p.m., and feed rates of the order of 0·0064 in. per rev., an output of 33 shafts per hour is obtained. The tools are set to leave 0·007 to 0·010 in. on the diameters for removal by a subsequent grinding operation, but the groove *D* and the reduced diameter *F*, Fig. 1, are finished to size. A close-up view of the set-up on the adjacent machine, for turning the remainder of the shaft, is given in Fig. 7, and it will be seen that the arrangement is somewhat similar. Here, the two tools on the rear slide are again plunge-fed. One of these tools cuts a chamfer at the end of the largest diameter portion, and the other, a chamfer of special form, on the left-hand end of the portion *G*, Fig. 1.

On this lathe, the front saddle is fitted with a slide, which is cam-fed to a fixed depth before the saddle is traversed during the automatic cycle. Secured to this slide there are three tools which turn the smaller diameter at one side of the portion *G*, Fig. 1, and the two larger diameters on the other side. In addition, two cam-controlled tool-slides are provided, of the type described in connection with the previous machine, and the movements of these slides are governed by

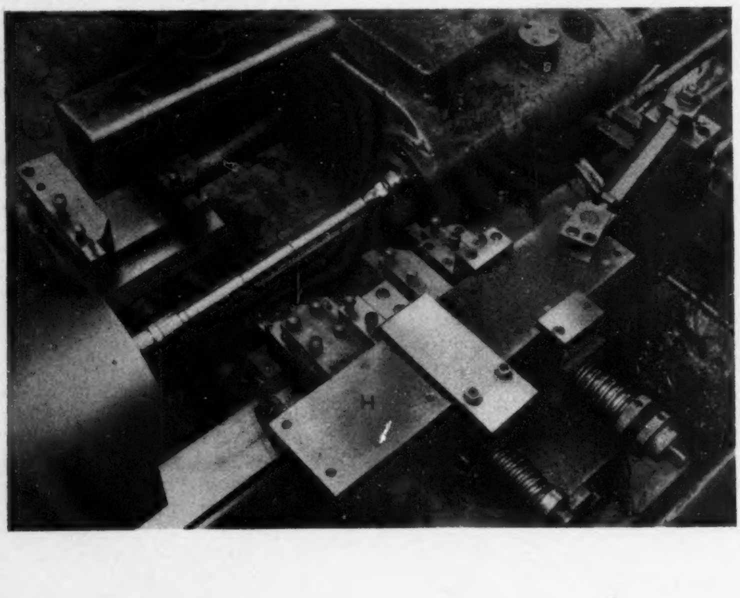



**Fig. 7. For Rough-turning the Smaller-diameter End of the Shaft, Another Lo-Swing Lathe is Employed with this Set-up which Incorporates Two Cam-operated Tools on the Front Slide and Form Tools at the Rear**

cam surfaces on the under-side of the plate *H*. This plate is connected by a link bar to a bracket at the end of the bed so that it remains stationary during the longitudinal travel of the saddle, and one of the independent slide tools turns three diameter steps at the tailstock end of the shaft. The other tool turns the diameter *G*, Fig. 1, and forms the recess near one end. A spindle speed of 1,100 r.p.m. is employed, with a feed rate of 0·009 in. per rev., and allowances of 0·007 to 0·010 in. are again left on various diameters for subsequent grinding operations.

These turning operations release internal stresses in the shafts and the latter are next straightened, on a 20-ton capacity mechanical press, to within 0·005 in. total indicated run-out. Then, they are passed to the next machine in the line, which provides for drilling the central hole in one end to a diameter of 0·4813/0·4833 in., and to a depth of $14+\frac{1}{16}-0$ in. This hole, as previously mentioned, receives a valve which controls the flow of hydraulic oil during the operation of the automatic transmission system.

### KRUEGER BARNES DEEP HOLE DRILLING MACHINE

The 5-spindle machine employed for the deep-hole drilling operation, shown in Fig. 8, was built by the H. R. Krueger Co., a division of W. F. & John Barnes Co., U.S.A. Each of the spindles of this machine, at the left-hand end in Fig 8, is driven by its own 3-h.p. motor, and is fitted with a live centre and a work-driving chuck which is tightened by a socket spanner. At the tailstock end, each shaft is supported in a close-fitting bush, which can be moved axially, to engage the work, by means of a ball-handled lever, as indicated at *J*. After the shaft has been loaded and the bush advanced, it is secured in position by raising the lever to the position shown, which brings a cam-lock into operation.

The housing containing the tailstock bushes is also equipped with steadies for the five gun-drills employed. Each drill passes through a hardened steel bush aligned with the shaft axis so that it is guided accurately during the initial stage of the drilling operation. Each drill is about 36 in. long, and is clamped in a holder on the saddle at the right-hand end of the machine bed, so that it cannot rotate. The saddle is fed towards the work at the rate of $1\frac{7}{16}$ in. per min., and with the spindles running at 1,800 r.p.m. the feed is about 0·0008 in. per rev., and the cutting speed, 72 ft. per min.

A close-up view of one of the drills, showing some details of the form, is given in Fig. 9. It incorporates a carbide tip with two cutting edges ground to an included angle of about 120 deg., and designed to produce swarf in the form of small chips. An off-centre hole extends for the entire length of the drill, through which Edgar Vaughan's 621.KL. broaching oil is pumped to cool the cutting edges and to carry away the swarf produced, along the deep, straight flute. A Roper pump driven by a 15-h.p. motor delivers the oil at a pressure of 200 lb. per sq. in., and it emerges within the tailstock housing. A filter prevents the swarf from being carried back to the tank. The machine cycle occupies about 9½ min., and some 25 shafts are drilled per hour.

The holes produced are sufficiently accurate to be honed at a later stage to limits of 0·4838/0·4848 in. without an intermediate grinding or reaming operation, and they are checked for size, as the shafts are unloaded, with the aid of a

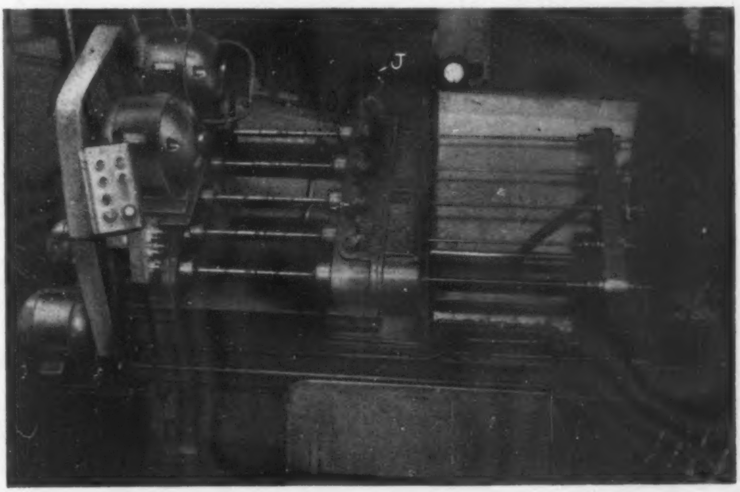



**Fig. 8. The 0·4813/0·4833-in. Diameter, 14-in. Long Central Bore is Gun-drilled in Five Shafts at Once on this Krueger Barnes Machine, on which a Separate 3-h.p. Motor is Employed to Drive Each Spindle**

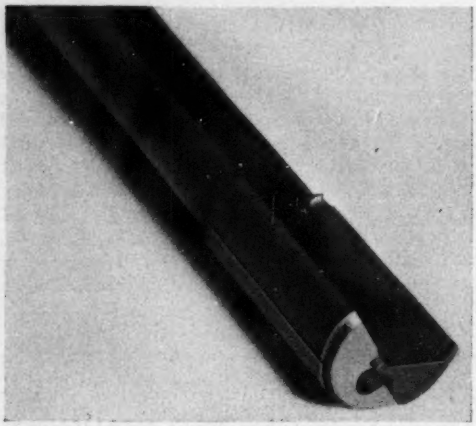


**Fig. 9. Close-up View of the Tip of One of the Carbide-tipped Gun Drills Employed on the Machine in Fig. 8, Showing the Central Hole Through which the Cutting Oil is Pumped and the Form of the Cutting Edge**

Sheffield Precisionaire (M.P.J. Gauge & Tool Co., Ltd.) air gauge.

### KRUEGER BARNES MULTI-SPINDLE DRILLING MACHINE

Another Krueger Barnes machine, shown in Fig. 10, is employed for the next operation on the shaft. This machine is employed to complete the operations on the shaft bore, apart from final honing, and has a total of eight spindles in the head at the left-hand end of the bed The spindle head is moved hydraulically on two parallel cylindrical bars supported on brackets on the machine bed and carries a spindle-driving motor of 5 h.p. Shafts are held in an eight-position indexing drum in the head at the right-hand end of the bed, and as the drum is turned each shaft is successively aligned with the axes of the various spindles. Due to improvements in the tooling which have enabled more than one diameter to be finished by certain tools, only four of the spindles are employed for this operation, but the drum-indexing mechanism continues to move each shaft through an angle of 45 deg. at each machining cycle.

A close-up view of the work clamping arrangements, looking through an aperture provided for loading purposes in the work-head casting, is given in Fig. 11, and it will be seen that each shaft is held in V-locations near the centre and at the left-hand end, adjacent to the tools. End-wise positioning is taken from the face adjacent to the diameter *D*, Fig. 1, which is pushed by the operator into contact with a stop provided in the central locating block. Adjacent to each V-location there is a lever-type clamp, with a slot whereby it is mounted on a central stud. A bracket near the outer end of each lever carries a cam which is turned to apply the clamping pressure, and the cam is also provided with a peg. This peg engages a hole in the clamp as the cam is turned, so that the clamp is moved forward to a position above the work, or retracted from it, automatically.

The operations carried out on this machine include the enlargement of the central hole to a diameter of ½ in. for a depth of 3$\frac{11}{16}$ in., and drilling and reaming the two largest bores at the extreme end, also re-cutting the centre. After unloading a com-

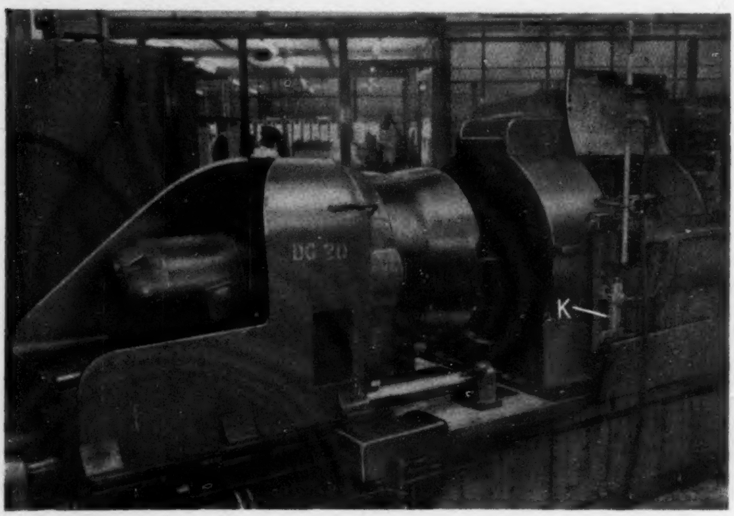



**Fig. 10. Another Krueger Barnes Machine, with an 8-spindle Head, is Employed for Operations on the Enlarged End of the Main-shaft Bore. Combination Tools are Now Employed and Only Four of the Spindles are Required**

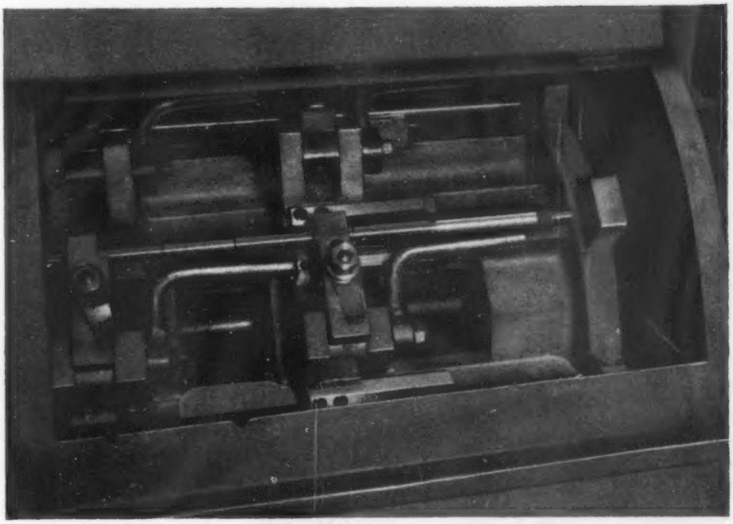


**Fig. 11. View Inside the Work-head Casting of the Machine in Fig. 10, Showing the Method of Locating and Clamping the Mainshafts, which Rest in V-locations and are Held by Peg and Cam-type Clamps**

pleted shaft and replacing it with a fresh component, the operator presses a button to start the automatic cycle of the machine, and the spindle head is fed forward at 4 in. per min., with the spindles running at 500 r.p.m. At the end of the cycle, the head withdraws and the drum is indexed for unloading. A hydraulic cylinder *K*, Fig. 10, at the front of the machine, is first energized to withdraw the drum-locating plunger, and oil pressure is then transferred to one end of another cylinder, which turns the drum.

This cylinder is seen at *L* in Fig. 12, which shows the indexing mechanism at the right-hand end of the machine, and oil is supplied through a hollow piston rod which is secured to the machine casting at each end. On the lower side of the cylinder there is a rectangular projection with rack teeth which mesh with a pinion carried on the end of the drum spindle. The pinion can be connected to the drum by means of a positive-acting clutch, operated, through a stirrup lever, by another hydraulic cylinder beneath the spindle housing. When oil is supplied to one side of the piston, the cylinder *L* is caused to move on its piston rod, and, if the clutch is engaged, the drum is turned through about 45 deg. At the end of its travel, a pin projecting from the end face of the cylinder, as at *M*, passes through a hole in the head casting and operates a micro-switch to initiate the next movement in the cycle. After the drum has been turned to the new position, the locating plunger is advanced into engagement, and the clutch-operating cylinder is energized to disengage the clutch. The cylinder *L* can then be returned to its original position, ready for the next indexing movement.

Another operation on a Lo-Swing lathe follows,

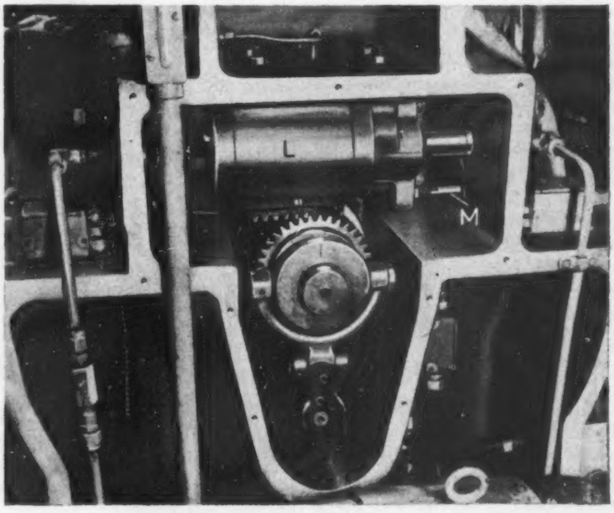



**Fig. 12. The Drum Carrying the Mainshafts on the 8-spindle Krueger Barnes Machine is Indexed by this Mechanism, which Includes a Moving Hydraulic Cylinder *L*, with Rack Teeth on the Outside**

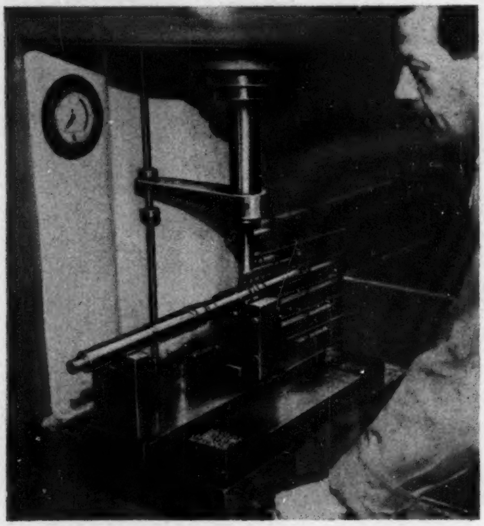


**Fig. 13. The Outer Ends of the Radial Holes Drilled in the Mainshaft are Peened with a Bearing Ball on this Press, to Ensure that there are no Loose Metal Particles which Might Become Detached in Service**

and this machine is fitted with a rear, plunge-forming slide only. The slide carries a total of four tools, of which three are of special form and produce two radii and five grooves, including the two wide grooves between those for the O-ring seals at *U*, Fig. 1. These grooves can be clearly seen on the third shaft from the top in the heading illustration. The fourth tool serves to chamfer the smaller end of the shaft. Holding and driving arrangements are similar to those described in connection with Fig. 6, except that more of the shaft projects from the chuck. A bracket secured to the bed ways near the position occupied by the centre of the shaft carries two rollers, which provide support against the pressure exerted by the forming tools. Drilling of the communicating oil holes, some of which pass right through the shaft, and others only into the central bore, is next carried out on an Edlund pillar-type machine.

### BALL-PEENING HOLE EDGES

Since the shaft is to be employed in a hydraulically-operated unit it is important that no metal particles should be left partly attached to machined edges with the possibility that they might later break off and enter the oil. To avoid this possibility, the edges of the drilled holes are next peened with the aid of a bearing ball of $\frac{7}{32}$ in. diameter, on a Denison Multipress, set-up as shown in Fig. 13. This operation also serves to chamfer the hole edges slightly. The shaft is supported on two V-blocks, one of which is adjustable for position, and is turned so that each hole faces upwards and is beneath the press ram, in succession. A ball is then placed in position on the hole and the ram is brought down until a pressure of 2 tons is exerted, as registered on the gauge. One of the drilled holes is in the recess in the portion *G*, Fig. 1, and a latch is provided in the V-block, which is raised to enter this recess, so that the shaft is fully supported when this hole is being peened. A fresh ball is employed for each shaft.

### HIGH-FREQUENCY HARDENING OPERATIONS

Surface hardening of the portions of the shaft indicated in Fig. 1 is next performed on a special Ther-Monic unit supplied by the Induction Heating Corporation, which provides for treatment in two separate fixtures. One of these fixtures, shown in

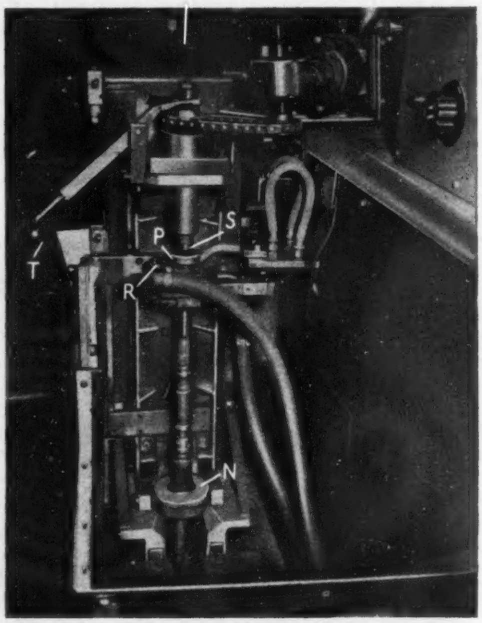



**Fig. 14. One of the Two Fixtures on the Induction-heating Unit for Surface-hardening Certain Portions of the Mainshaft is Arranged to Rotate the Work and Lower it Through a Heater Coil and a Water-spray Quench**

Fig. 14, is employed for hardening the portions of the shaft at the centre and the left-hand end in Fig. 1. The fixture has a vertical slide which is raised and lowered by an air-hydraulic cylinder on the far side of the unit. On this slide, there is a trunnion-mounted bearing for the lower end of the shaft, which fits into a hole in the plate *N*, of the bearing, and rests on the shoulder adjacent to the diameter *D*, Fig. 1. The slide is here shown in the position which it occupies at the end of the hardening operation, and it is raised automatically, to an upper setting, for unloading and loading the work.

In this loading position, the plate *N* of the bearing is just below the stationary 2-turn inductor coil *P* and its associated annular water-spray cooling tube *R*, which are mounted on brackets on the face of the generator cabinet. The shaft to be loaded can then be inserted through the coil into the hole in the bearing plate *N*, and the upper end engaged with a driving centre S.

This centre can be raised, and lowered to engage the shaft, by means of the ball-handled lever *T*, and has a pulley at its upper end whereby it can be driven by a small Klaxon geared motor unit, carried on a bracket at the top of the slide, through a belt. After loading a fresh shaft, the automatic cycle is started by depressing a button, and the shaft-driving motor and the generator are then switched on.

The slide now starts to move downwards at a rate controlled by the hydraulic check cylinder of the feed unit, the speed being determined by dogs on the rear of the slide, which operate a series of micro-switches to increase or decrease the rate of oil flow.

Various changes in the rate of feed provide for fast traverse when areas which are not to be hardened are passing through the coil, so that they are not heated unduly, and for differences in diameter of the areas to be hardened. With an output of 50 kW., the generator, which is of the valve-operated type, gives a frequency of 450,000 cycles per sec., and the feed rate is chosen so that a depth of hardening between 0·070 and 0·1 in. is obtained. The hardness is between 58 and 62 Rockwell C at the surface, and about 50 Rockwell C at a depth of 0·035 to 0·050 in. The hardening cycle occupies a period of about 30 sec.

From the fixture shown, the shafts are transferred to another, on the same generating unit, in which the portion at the right-hand end in Fig. 1 is hardened, with a much simpler set-up. Here, the shaft is loaded, again with the small-diameter end upwards, into a bush in which it rests on its end surface, and the bush is driven from beneath so that a more even hardness pattern is obtained.

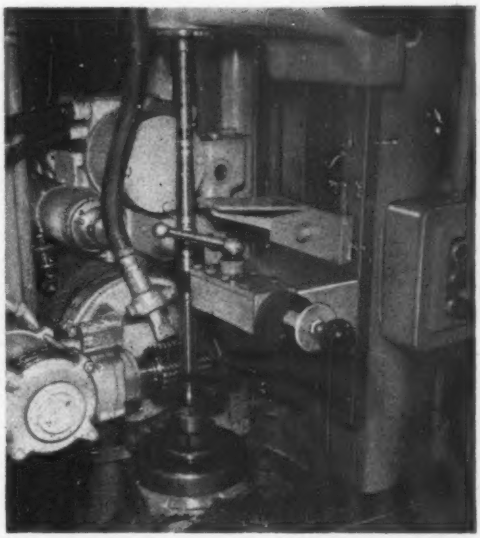


**Fig. 15. Three Sets of Splines on the Mainshaft are Hobbed on a Lees-Bradner 8-spindle Continuous Rotary Machine. The Set-up for Hobbing the Longest Splined Portion is Here Shown**

The portion of the shaft to be hardened is surrounded by a 10-turn inductor coil of sufficient length to render a scanning movement unnecessary, and the shaft is automatically raised into a water-spray quenching ring at the end of the heating period, which occupies 12 sec. This hardening unit has an output capacity of 32 completely treated shafts per hour.

Shafts are next tempered, to release stresses set up by the hardening operations, in a Holcroft gas-fired furnace, in which they are held at a temperature of 180 deg. C. for one hour. Subsequently, they are inspected for cracks in a Fel-Electric machine and demagnetised. The centre holes at each end are then re-finished with a diamond lap, and the shafts are straightened to within 0·005 in. total indicated run-out, on an Oldfield & Schofield press of 20 tons capacity, before the plain diameters are rough ground on one of a number of Landis [E. H. Jones (Machine Tools), Ltd.] 10- by 30-in., H-type, cylindrical grinding machines. Two form-dressed wheels are employed to plunge-grind a total of seven diameters, leaving the recesses and undercuts for later operations, and the shafts are then checked for concentricity of these diameters on a special gauge incorporating a number of dial indicators.

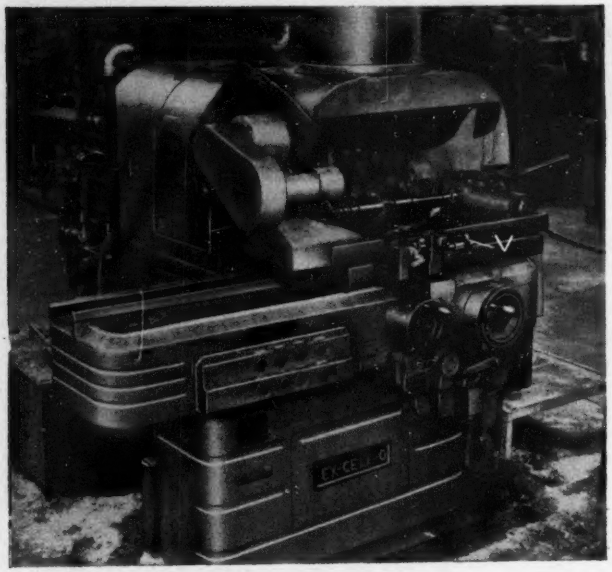


Fig. 16. This Special Ex-Cell-O Machine is Employed to Plunge-grind the Three O-ring Seal Grooves *U*, Fig. 1, to a Depth of 0·065 in., from the Solid. A Single Wheel is Applied to Grind the Grooves in Succession

### SPLINE-HOBBING OPERATIONS

Three sets of splines, as shown in Fig. 1, are then hobbed on one of two Lees-Bradner (Dowding & Doll, Ltd.) 8-spindle production-type machines, a typical set-up, for cutting the long splines at the larger-diameter end of the shaft, at the right in Fig. 15. This splined portion has 10 grooves with a root diameter of 0·990/1·005 in., and a full-depth length of 3⅞ in. Of 3½ in. diameter by 4 in. long, the single-start hob employed has 20 gashes, and is run at a speed of 100 r.p.m. The cycle time for cutting these splines is 1·23 min., and various operations are performed at the other seven machine stations, at the same time, including the hobbing of the other two sets of splines on the mainshaft. Edgar Vaughan's Frapol 10/88 cutting oil is employed for the set-up shown.

### SPECIAL EX-CELL-O GRINDING MACHINE

Subsequently, the three grooves *U*, Fig. 1, which accommodate O-ring seals in the final assembly, are ground from the solid, to a depth of 0·065 in., on the special Ex-Cell-O No. 33, machine shown in Fig. 16. Vaughan's thread-grinding oil is employed on this machine and the speed of the wheel and the nature of the operation combine to produce a fine mist of oil droplets. For this reason, the machine is almost completely encased in sheet metal covers to confine the oil and reduce the loss to the atmosphere as much as possible. The shaft is held between centres, and is driven by the motor at the left-hand end of the table, through V-belts and a driver which engages the involute splines at the smaller end.

A Norton A80-T9-BH wheel is employed, and is dressed automatically to a size which will produce the required groove width of 0·1095/0·1115 in. The sides of each groove must be finished to within 25 micro-inches, and must be parallel within 0·0005 in., and square with the shaft axis within 0·0005 in. total indicator reading. The machine is arranged to operate on an automatic cycle, which is performed each time the cycle-start button is pressed, and provides for rapid advance of the wheel, plunge grinding at a slow feed rate, rapid withdrawal, and stopping. After loading a shaft between the centres, the button is pressed, and the first groove is finished. The table is then indexed, by hand, to bring the next groove into line with the wheel, with the aid of a horizontal shaft which is mounted in brackets on the front of the machine bed.

This spindle can be turned by means of the star wheel *V*, and locked in any position, and it carries three square-section projecting fingers arranged at different angles, each of which can be engaged with a slot in a steel block secured to the vertical face of the machine table. Indexing of the table is effected by turning the shaft until all the fingers are disengaged from the table, which is then moved sideways, by means of the normal handwheel, until the next finger on the shaft is aligned with the slot.

The grinding wheel, of about 15 in. diameter, is driven at 2,450 r.p.m., and the grinding cycle occupies approximately 30 sec. per groove. After every third shaft has been ground, the automatic wheel-dressing unit, which incorporates three diamonds, comes into operation to dress the wheel face and the side surfaces to the required width.

**SHEFFIELD SPLINE DE-BURRING MACHINE**

The ends of the involute splines at the smaller-diameter end of the shaft are now de-burred, to permit easy assembly of the unit with the torque converter, on a special Sheffield machine, which is shown in Fig. 17. On this machine, the shaft is held in a collet chuck in which it is located in the correct angular position by means of three equally-spaced internal projections. These projections engage the splines on the shaft end to locate them relative to the cutter. The weight of the other end of the shaft is taken on an outboard support, which is carried on brackets attached to the side of the machine.

Axial positioning of the work is obtained by pushing the end into contact with a roller carried on a shaft in the centre of a swinging bracket, before the collet chuck is tightened with the aid of a key. The collet chuck is driven through worm reduction gearing from a small motor, and an extension on the worm shaft drives another shaft *W*, at 90 deg. to the axis of the work. Near the end of the shaft *W* there is a square-section aperture, in which is clamped a single-point tool of special form, and the shaft is driven at 10 times the speed of the work. The rotation of the work and tool-shaft is so timed that the tool passes across each groove between adjacent splines, removing the hobbing burrs, as the groove reaches the lowest position. Further de-burring and smoothing operations are performed at this stage on a small lathe, by means of a wire brush and other hand tools, and the shafts are degreased in a paraffin bath.

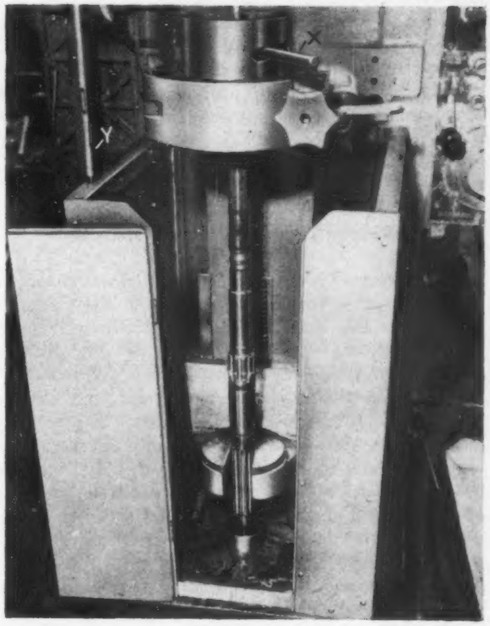
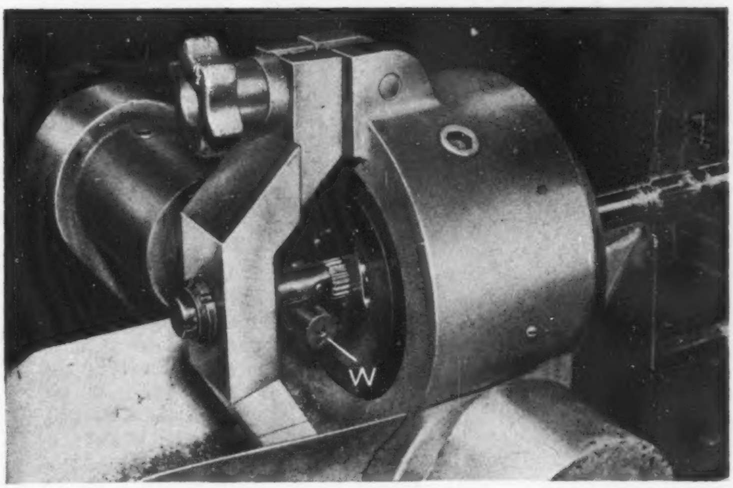



**Fig. 18. Set-up on a Micromatic Honing Machine for Finishing a 7-in. Length of the Internal Bore to a Diameter of 0·4838/0·4848 in.**

**Fig. 17. Removal of the Burrs Thrown Up at the Ends of the Involute Splines on the Smaller-diameter End of the Mainshaft is Performed on this Special Sheffield Machine**




Five plain and two splined portions are finish-ground, to the diameters indicated in Fig. 1, on one of the Landis machines mentioned previously, and an Ex-Cell-O fine boring machine is then employed to finish the 0·5625/0·5635 in. bore in the front end of the shaft (on the car). This bore is required to be concentric with the ground diameters within 0·005 in. total indicated run-out, and after boring

has been completed, a special tool is inserted into the hole to remove any burrs round the oil-transfer holes where they break through the walls. Inspection of the bore with a special lamp, and a shield provided with a sighting hole, is carried out before the bore is honed for a length of slightly more than 7 in., to the 0·4838/0·4848 in. dimension, on a Micromatic (A. A. Jones & Shipman, Ltd.) vertical machine.

### MICROMATIC VERTICAL HONING MACHINE

A close-up view of this machine is given in Fig. 18, and it will be seen that the shaft is supported on the larger end and positioned by a slotted locator. The upper end of the shaft is engaged by the cone end of a bush which is moved vertically by the action of a cam slot on a handle *X*, attached to the side of the bush. The slender honing tool, seen at *Y*, is fitted with six stones in equally-spaced slots near the lower end. These stones are arranged in two sets of three, one set above the other, since the size of the hone would not permit them to be mounted side by side. Each stone measures 1¼ by 7/16 in. and is moved outwards into contact with the walls of the bore by a tapered arbor, in the usual manner. Honing is manually controlled, and the operator measures the bore at intervals, to determine the amount of material still to be removed at three different positions, with an air-jet type of gauge. Honing oil supplied by Edgar Vaughan & Co., Ltd., is employed for this operation and the machine table is fitted with a sheet metal guard to prevent loss by splashing.

### PLAN-O-MILL PLANETARY THREAD-MILLING MACHINE

Apart from the final inspection, the series of operations is completed by milling the ¾-in. diameter by 16 U.N.F.-2A thread on the larger end of the shaft, on a No. 1 Plan-O-Mill machine with the set-up shown in Fig. 19. The work is held by the large-diameter splined portion in a collet chuck, and is positioned end-wise from the shoulder adjacent to the diameter *D*, Fig. 1, which is pushed into contact with a stop before the collet is tightened by means of the ball-handled lever. A 2½-in. diameter by 1-in. long thread-milling cutter, with 12 gashes, is employed to cut the thread, and is mounted on the end of the spindle in the eccentric head. The portion of the head carrying the cutter spindle is arranged to turn initially, so that the cutter can be fed into the work to the required depth when the automatic cycle is started by pressing one of the buttons shown.

With the cutter advanced to depth, the main head starts to rotate, and, at the same time, is moved towards the shaft by a threaded portion of the same pitch as the thread to be cut. This threaded portion is engaged by a ring with an internal thread, which is mounted in the headstock casting. When the planetary head has turned through slightly more than 1 rev., to produce a complete thread, in a period of 35 sec., the spindle carrier is turned back to its original position to retract the cutter from the work, and the direction of rotation of the main head is then reversed. At this stage, the speed of rotation of the main head is increased so that it returns to the starting position, where it is stopped automatically, in only 7 sec., and the shaft can then be unloaded.

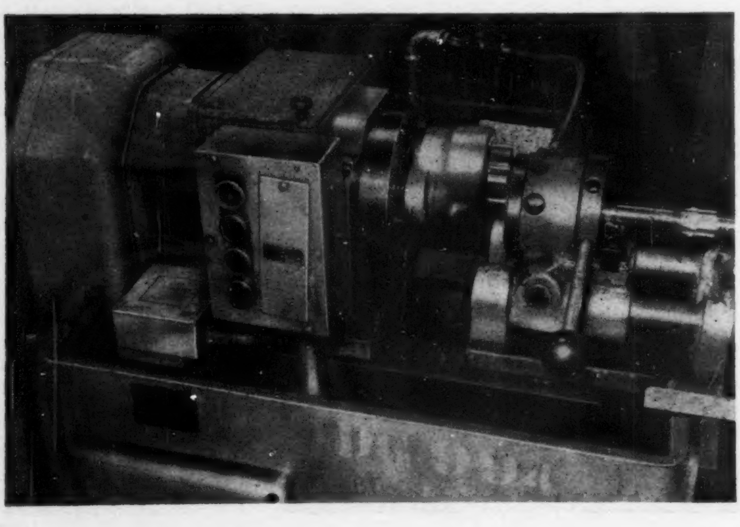


**Fig. 19. At the Final Operation on the Mainshaft, Apart from Inspection, the ¾-in. Diameter Thread on One End is Cut on this Plan-O-Mill Planetary Thread-milling Machine**

# Wade Furnaces for Brazing Stainless Steel and Heat-treating Jet Pipe Assemblies

Heat-treatment equipment installed by Joseph Lucas, Ltd., in their Burnley factory includes two types of electric furnaces designed and constructed by A. R. Wade & Co., Ltd., North Lane, Aldershot, Hants. One type of furnace, of which many have been constructed, is of horizontal construction and is employed for brazing stainless steel and Nimonic parts. The other furnace, a large vertical pit type, is designed for the solution annealing of jet pipe assemblies.

For the operations performed in the horizontal type of furnace, which is illustrated in Fig. 1, a high, uniform, operating temperature and a reducing atmosphere free from impurities are essential. Heating elements, made from Brightay (Henry Wiggin & Co., Ltd.) nickel-chromium-aluminium resistance alloy, are mounted outside a nickel-chromium muffle in which a temperature of 1,170 deg. C. is maintained. With this arrangement, the elements are not in contact with the reducing atmosphere which is derived from cracked ammonia. The cracker plant in which the ammonia is converted into a mixture of nitrogen and hydrogen is shown at *A*. On leaving the plant, the gas mixture passes into one of the drying towers, shown at *B*, which are packed with alumina. Here, the remaining traces of ammonia are removed from the gas which, with its dew-point reduced to below −60 deg. C., is piped to the furnace chamber. When the dew-point shows signs of rising above the figure quoted, the gas is diverted into a second drying tower while the alumina in the first tower is dried by an electric heating element. This procedure is repeated for the second tower, when necessary.

In the furnace, the gas mixture, being lighter than air, rises to the highest part of the heating zone where the brazing operation is carried out. The gas is maintained under light pressure and is ignited at both furnace openings where the hydrogen content is consumed at the rate of 80 to 100 cubic feet per hour. Access to the interior of the furnace for maintenance purposes, can be gained through the roof of the structure.

The conveyor belt, part of which can be seen at *C*, was made by the British Wedge Wire Co. from Nimonic DS, which has exceptional hot strength and resistance to creep. In this instance, as a further precaution against stretching, the driving tension is applied to a cold portion of the belt. This particular furnace has been in use for more than a year, and is stated to have given good results. After the furnace has been shut down at week-ends, the temperature is raised to the required level for brazing in slightly more than 7 hours.

The second furnace mentioned above is believed

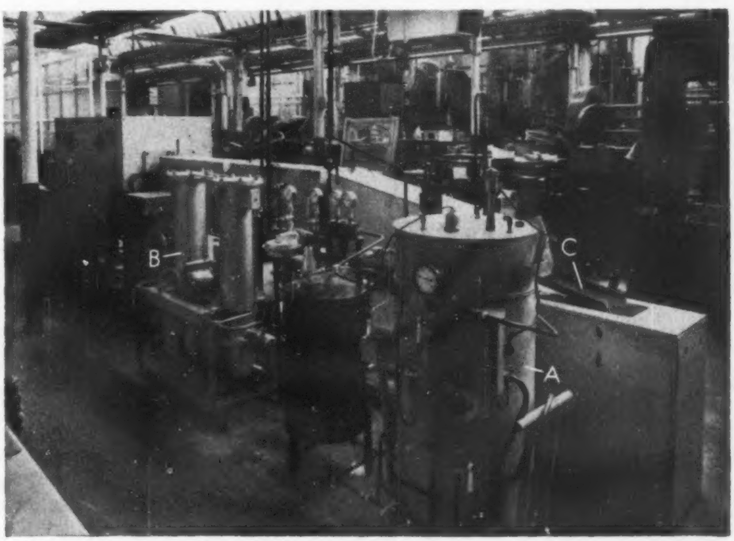



**Fig. 1. Horizontal Furnace for Brazing Stainless-steels and Nimonics in a Controlled Atmosphere**

to be one of the largest of its type at present in use in the United Kingdom. It was specially designed for the heat-treatment of large units fabricated from Nimonic, and is employed for hardening at temperatures between 800 and 850 deg. C., and solution annealing at 1,100 to 1,200 deg. C. Fig. 2 shows the installation with a pipe assembly for a jet propulsion unit being lowered through the furnace opening into the heating chamber. The greater part of this vertical furnace, it may be observed, is contained in a rectangular pit which is 21 ft. in depth and has a floor area of 20 ft. by 13 ft. At ground level, the pit opening is covered with steel gratings, some of which have been removed so that the base of the furnace may be seen in the illustration. Weighing approximately 30 tons, the furnace has an internal diameter of 8 ft. and a height of 21 ft.

The casing, which comprises three cylinders made from ¼-in. thick steel plate and joined end to end, encloses a refractory lining. For the topmost portion of the furnace, on which the door fits, Morgan castable refractory material was employed. In the surface of this section, there is an annular groove, at *A*, filled with a layer of fireclay which provides a seal medium between the chamber opening and a narrow rim on the lower edge of the circular furnace door. Three slots, two of which are visible in the illustration, are provided in the refractory surround to accommodate the arms of a spider at *B*, on which the work is supported. The spider was fabricated from Nimonic and is designed to support suspended loads up to 6 cwt.

Weighing approximately one ton, the furnace door is attached to an arm which is supported on a hinge pin provided with roller thrust races. A hydraulic ram, mounted inside the cylindrical boss at *C*, provides for raising or lowering the door through a distance of 5 in., in relation to its supporting arm, when it is being manœuvred over the furnace opening. This hydraulic ram, and the motor of the hoist from which work is suspended, are controlled from the pendant seen in the figure.

Wiggin "Brightray" elements, which are installed on the inner surface of the furnace lining in a sinusoidal pattern, have a combined load of 275 kW. There are three heating zones, each provided with carefully positioned thermocouples, which, in conjunction with the electrical control equipment, enable the temperature to be maintained within ±5·0 deg. C., in the lower range, and ±10·0 deg. C., in the higher range, to meet the specified heat-treatment conditions.

On the floor of the pit, adjacent to the base of the furnace, is installed a large enclosed fan with a capacity for delivering 10,000 cu. ft. of air per

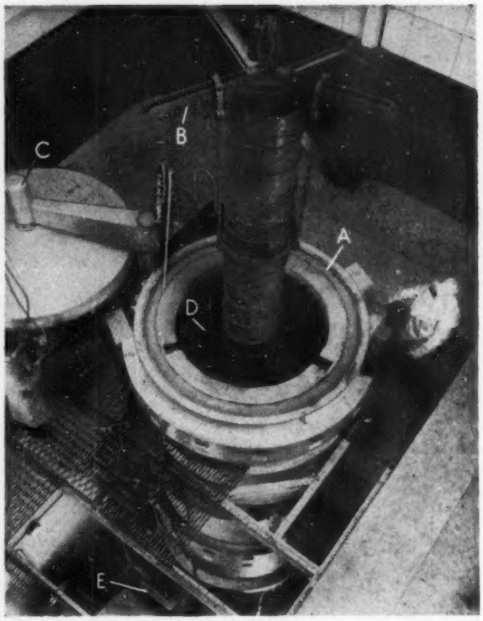



**Fig. 2. Electrically-heated Vertical Furnace Built by A. R. Wade, Ltd., for the Heat-treatment of Large Pipe Assemblies for Jet Propulsion Units**

min. against a head of 2 in. water gauge. By means of ducting, the fan and the furnace chamber are joined to form a closed circuit through which air, heated by contact with the elements, is circulated. The fan bearings are water-cooled. Air is delivered to the base of the furnace, whence it is directed upwards through three main ducts past the outside surface of the detachable liner *D*. It is then deflected downwards into the bore of the liner, in which the work is located, and out through the centre of the furnace base to the fan intake. The liner is made from Nimonic 75, and is in three cylindrical sections, secured together by shackles, which are fitted with pins arranged for easy withdrawal.

When the furnace is used for the heat-treatment of work in the 1,100-1,200 deg. C. range, the liner is removed and the fan shut down. A sluice-type insulated door *E*, in the delivery ducting, is then closed to prevent air at high temperature from entering the casing of the stationary fan. A safety device, in the form of an electrical interlock between the fan motor and heating element circuits, prevents high temperature conditions being obtained with the fan running. There is also an

electrical-mechanical interlock which ensures that the door of the furnace cannot be opened accidentally when heat-treatment is in progress. The furnace has been so designed that it may be extended by the addition of extra sections to accommodate pipe assemblies of greater lengths than those in current production. Operators engaged in the manipulation of work in the vicinity of the heated furnace chamber are provided with protective clothing, as seen at the right.

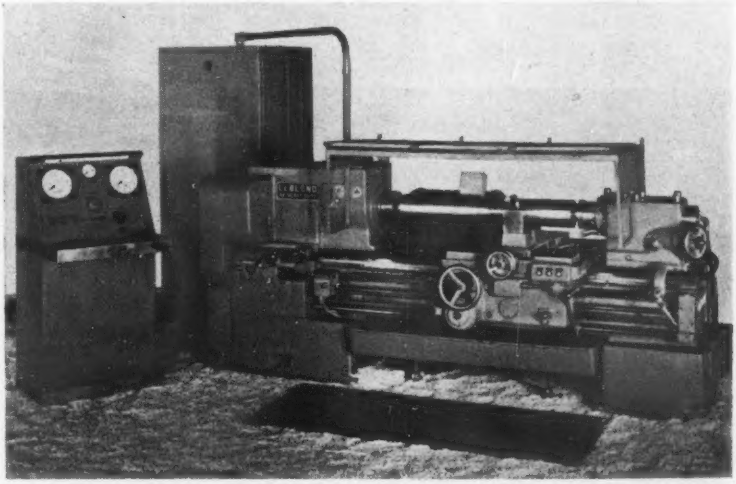
# Le Blond 20-in. Heavy-duty High-speed Lathe

A new 20-in. heavy-duty lathe, driven by a 150-h.p. motor, was recently built by the R. K. Le Blond Machine Tool Co., who are represented in this country by Wickman, Ltd., Fletchamstead Highway, Coventry. This lathe, which is shown in the accompanying illustration, is intended for high-speed machining research on ceramic and other tools. It incorporates the standard bed, saddle, apron and feed box of the company's 20-in. heavy-duty lathe, but has a specially designed, high speed headstock and control unit, and tailstock. The headstock provides for the transmission of 150 h.p. at speeds which are steplessly variable from 250 to 5,000 r.p.m., and the spindle is supported at three positions, axial location being provided by a pair of radial-thrust bearings near the centre.

Final drive is transmitted by multiple V-belts to a 7½-in. diameter pulley mounted between the central bearing and a roller bearing at the end of the spindle. A double-row staggered roller bearing is provided at the nose end, and all the bearings are pressure lubricated. The spindle diameter at the nose end bearing is 5¼ in. and the bearing is designed to withstand radial loads up to 4,375 lb. at 5,000 r.p.m. Of 6½ in. diameter, the tailstock quill is fitted with a built-in live centre, the bearings of which are pressure lubricated. Oil is supplied from a reservoir which also serves the headstock, and oil is maintained at a constant temperature by means of a thermostatically-controlled heat exchanger. The standard feed box has been modified only by the addition of timing belt drives and nylon gearing to give a 2-step reduction. A range of 90 feed rates from 0·002 to 0·136 in. per rev. is thus provided.

The remote control unit for the lathe, seen on the left, incorporates separate start and stop controls for the motor and the spindle, also controls for the engagement and disengagement of the longitudinal and transverse feeds. There is another control for the stepless variation of spindle speed, the speed that is in use being shown on a dial, and the cutting speed and horsepower are also indicated. In addition, overload warning lamps and a timer are provided on the panel. All the controls normally employed for setting up are duplicated on the headstock and apron.

In a series of tests carried out on the machine, S.A.E. 1045 steel, of 180 Brinell hardness, in the form of a billet 48 in. long by 8 in. diameter, was machined with a ceramic tool. During the first test, carried out at a spindle speed of 5,000 r.p.m.,



**This 20-in. Le Blond Heavy-duty High-speed Lathe, Intended for Research on Ceramic and Other Cutting Tools, has a Motor of 150 h.p. and Steplessly-variable Spindle Speeds from 250 to 5,000 r.p.m.**

which gave a surface speed of approximately 10,000 ft. per min., a 0·110-in. deep cut was taken with a feed of 0·010 in. per rev., corresponding to a saddle traverse rate of 50 in. per min., and the horse power required was 138. A second test, at 4,300 r.p.m. (approximately 7,500 ft. per min.), with the same feed and cut, required 105 h.p. For a third test, a speed of 5,000 r.p.m., was again employed, but the diameter of the bar had been reduced to 6 in., and the cutting speed was therefore about 7,800 ft. per min. The depth of cut was 0·10 in., and the feed was 0·015 in., corresponding to a saddle traverse of 75 in. per min. Under these conditions 148 h.p. was consumed.

# Producing Large Thin-gauge Sheets by the "Sandwich-rolling" Technique

A technique for the production of large, thin-gauge, stainless-steel and alloy-steel sheets has been developed at the Homestead District Works of the United States Steel Corporation. With this process, thin-gauge sheets up to 90 in. wide by 230 in. long, which is nearly twice the width of those produced by previous methods, have been rolled, and it is anticipated that the method will be of considerable importance in providing sheet materials for use in connection with aircraft and missiles.

Basically, the process involves the construction of a "sandwich" consisting of a number of stainless-steel, or alloy steel, plates, which are enclosed between two carbon steel cover plates. The stainless-steel plates are each 5/16 in. thick, and are treated with a separating compound, and the carbon steel covers are 1 in. thick. A typical sandwich is seen in the accompanying figure, with six stainless-steel plates between the covers.

Next, the sandwich is sealed, by welding a bar of approximately triangular section along each of the four sides, one of these bars being seen in position, but not welded, at the right in the figure. When the sandwich has been completely sealed in this manner, it is heated to a suitable temperature and rolled. In this way, the thickness is progressively reduced to approximately 3/8 in., and the sandwich is then 100 in. wide by 250 in. long. Each layer is reduced proportionately, the total thickness reduction being of the order of 90 per cent. As a result, each of the 5/16-in. thick stainless-steel plates is brought to a nominal thickness of 0·030 in.

When the sandwich has cooled, the edges are trimmed to unseal the stack, and the thin-guage sheets can then be removed.

Among the advantages claimed for this technique is that, owing to the initial thickness of the pack, the rate at which heat is dissipated is considerably reduced, and less power is therefore required during the rolling process. It is stated that the sandwich retains sufficient heat for the entire rolling operation. Moreover, during rolling, the sandwich has the working characteristics of the carbon steel cover plates, rather than of the tougher stainless-steel plates contained therein, so that the rolling mill operates under less severe conditions.

**A Typical Sandwich is Here Being Prepared. It Comprises Six Stainless-steel Plates, Each 5/16 in. Thick, Between Two 1-in. Thick Carbon Steel Covers**

# Vinyl-metal Laminates

### *Their Properties and Applications*

By R. P. HOOKER*

Vinyl-metal laminated sheet offers to the product designer a pre-finished material that is strong, decorative, and easy to fabricate. The laminates can be deep-drawn, sheared, crimped, bent, punched, and drilled without injury to the bond or the vinyl, and with virtually the same ease as ordinary sheet metal.

Vinyl currently employed ranges in thickness from 0·004 to 0·020 in. It is received by the laminator in rolls embossed and printed in wood, leather, and marble grain; in cloth and basket-weave textures; and in metallized forms. Steel, aluminium, or magnesium, 0·015 to 0·060 in. thick, forms the backing. So strong is the bond between the metal and the vinyl that the material can be processed with standard metal-working tools and fixtures without damaging the finish. The laminates show high resistance to abrasion, rust, chemicals, and heat (up to 275 deg. F.).

* Arvin Industries, Inc., U.S.A.

Applications for these materials are numerous. Among present users are fabricators of luggage, furniture tops, appliance cases, camera cases, radio cases, business machine cases, doors, shelving, seat backs, thermos jugs, and motor car interior trim parts. Proposed uses cover an even more extensive field; advertising signs and displays, boat decks, motor car roof panels and fenders, trailer bodies, partitions, railway passenger cars, lawn furniture, sinks, and roofing may be mentioned as examples. Entire walls of the product, incorporating electric heating elements, have already been made. It is possible that this application could make existing room-heating methods obsolete.

In many instances, final costs may be less if laminate is employed as compared with the alternative of fabricating a part from metal and subsequently finishing it by spraying or plating. Labour involved in bonding vinyl to flat sheets of metal in a continuous process is much less than for

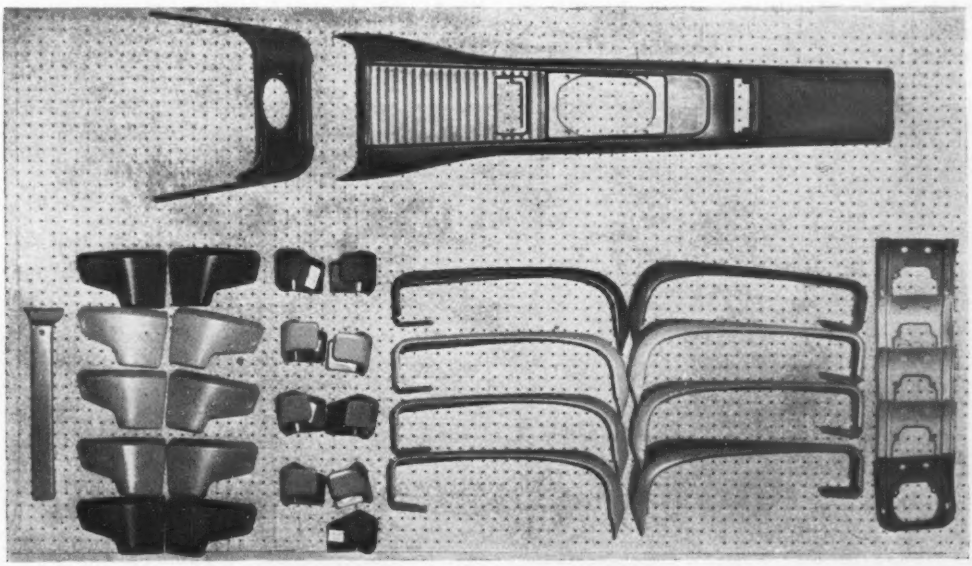


Fig. 1. Examples of Laminate Components Employed for the Interiors of 1958 Motor Cars. They are Made in a Variety of Colours

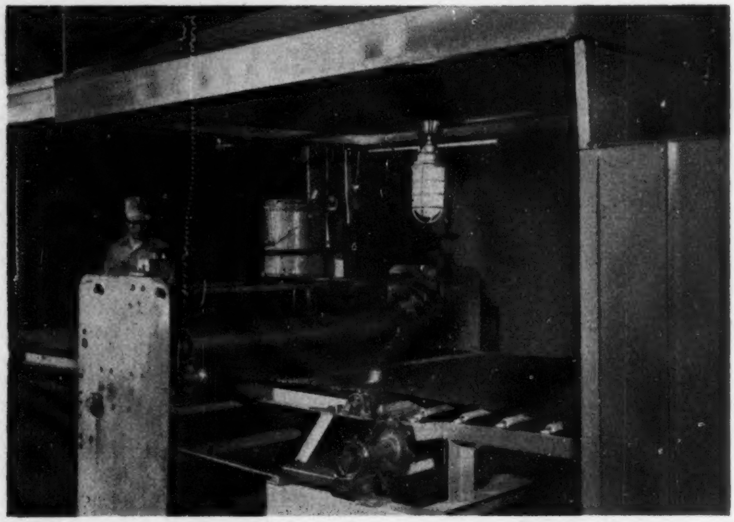


**Fig. 2. Operations on the Laminating Line Start with Roller-coating One Side of the Backing with Adhesive**

painting or plating individual stamped or drawn metal pieces. When a vinyl is used, moreover, there is no investment in ovens, spray booths, conveyors, spray guns, or stripping tanks; nor is there any need to inspect the finished work for tear drops, sags, or streaks. The backing can be of lighter gauge than a comparable all-metal sheet because of the bulk supplied by the vinyl, and further savings may thus be effected.

Among the leading laminators in the U.S.A. are Arvin Industries, Inc., Columbus, Ind. Arvinly laminates are already employed for many items in this company's ranges of radios, heaters, and fans. In addition, the firm has long been concerned with the supply of motor car parts, and laminates are being employed in the interiors of several 1958 models. Typical of these parts are the examples shown on the display board, Fig. 1. On the upper part of the board are front and rear console panels which cover the drive-shaft hump in the floor. Beneath it, from left to right, are a pillar cover, front and rear seat corners, right and left seat side shields, and console covers.

Since the bond between the metal and the adhesive is mechanical, increased strength is obtained by etching the surface of the metal so that it is porous rather than smooth. Incoming sheets (18 to 48 in. wide, and 55 to 144 in. long) are prepared on a 5-stage line. An alkaline hot spray is followed by a hot spray rinse, and the surface is then roughened (made porous) by phosphatizing. At the fourth and fifth stages, the sheets are

**Fig. 3. The Vinyl is Applied to the Sheet Immediately it Emerges from the Oven While the Adhesive Film is Still at the Required Temperature**

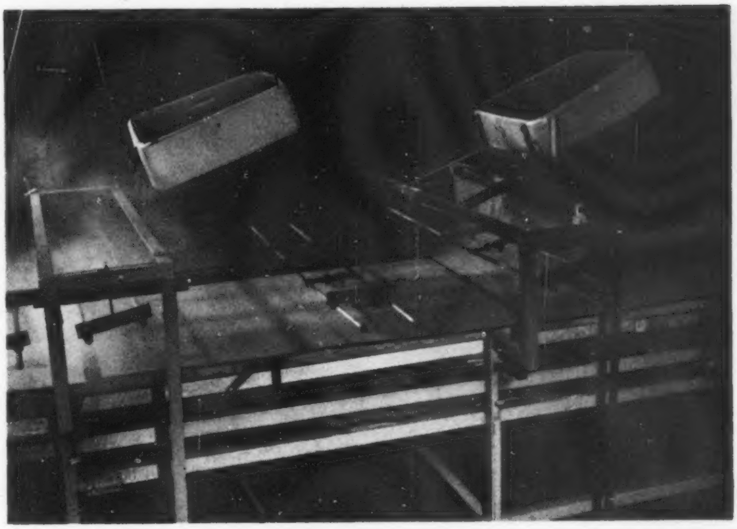


**Fig. 4. After the Sheets have been Cooled by a Water Spray, the Remaining Moisture is Blown off with Fans. The Laminates Can then be Stacked without Damage**

cold spray rinsed and chromic acid rinsed. The latter process seals the surfaces and neutralizes any alkalinity carried over from previous stages, which would otherwise weaken the bond.

As the sheets leave the fifth stage, they enter an oven, where the remaining moisture is quickly evaporated, and any streaking by the chromic acid is checked.

Sheets are next conveyed to the laminating line, where the bonding surfaces are first roller-coated with a thermoplastic adhesive, by means of the equipment seen in Fig. 2. The thickness of coating is 0·0025 to 0·005 in. and to obtain an even film, the viscosity of the adhesive is maintained within close limits, depending on the ambient temperature, by the addition of solvent.

Once coated, the sheets are preheated in a forced-air oven. The purpose of this treatment is to evaporate the solvent in the adhesive, and thus avoid any risk of explosion in the next oven in the line. Temperature in the preheating oven must be carefully controlled. It must be sufficiently high to evaporate the solvent, but must not cause it to boil in the film. Boiling leaves craters, which may result in objectionable indentations in the vinyl surface.

In the second oven, the adhesive is brought to a semi-liquid state, by raising sheet temperature to about 385 deg. F. The exact temperature will vary, depending on the thickness of the vinyl to be applied. Too low a temperature results in a weaker bond and too high a temperature causes the adhesive to carbonize, and may also affect the gloss and grain of the vinyl.

## APPLYING THE VINYL

Immediately after leaving the second oven, the sheets reach the laminating station, where the vinyl is applied. A roll of vinyl can be seen on the top of the stand between the operators in Fig. 3. The material is purchased in 250-yard rolls, from 18 to 48 in. wide, and is noteworthy for its close resemblance to cloth or leather. It is pliable, has good tensile strength, and is acid- and water-resistant.

As each sheet emerges from the oven, it meets the vinyl, and both advance between two rubber rolls. The lower roll provides the drive, and the upper roll applies the necessary pressure (60 lb. per sq. in.). For loading purposes, the ends of the upper roll are carried in levers which are controlled by air cylinders. Roll hardness and pressure are such that there is a slight flattening effect.

Vinyl slightly wider than the metal backing is employed so that it overlaps the edges. The roll pressure during laminating causes the vinyl to be scored along the edges of the sheet, and the operators are then able to strip off the excess material as the laminate leaves the rolls. Sheets follow each other through the oven with practically no gap between them. As a result, vinyl can be applied continuously with very little waste from one sheet to the next.

To set the bond and dry the laminate, the sheet is cooled by passing it through a cold-water spray and it is then subjected to an air blast beneath the two fans seen in Fig. 4. Cooling also prevents any loss in the embossing in the vinyl when the sheets are next stacked. Laminates with aluminium backing are now ready to be fabricated. For those with steel backing, a fast-drying rust preventive is roller-painted on the under-side before fabrication.

The laminated sheets are first cut to whatever blank size is required for the press operations, by

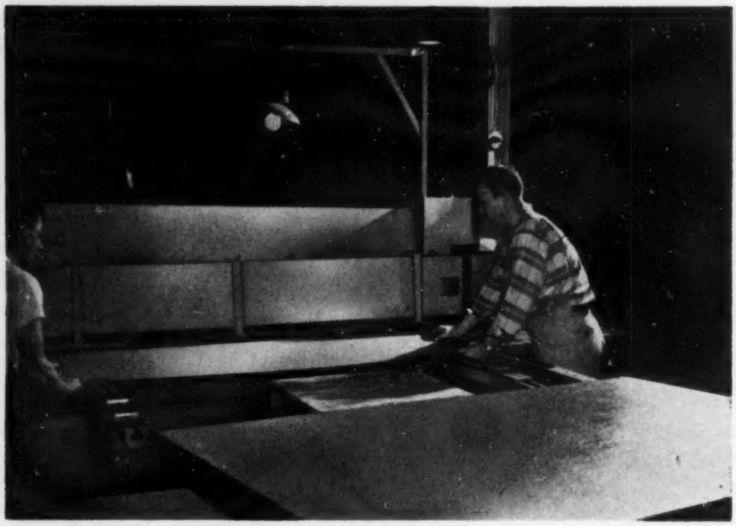


**Fig. 5. For Fabricating the Laminate, Sheets are First Cut to Blank Size. The Machine is a Niagara Power Squaring Shear**

shearing them individually as illustrated in Fig. 5.

Drawing is similar to conventional practice, with a few qualifications. Vinyl cannot be "crowded" but must be allowed to flow freely. Draw beads, used to control the flow of the material into the die, are employed more frequently than in ordinary dies. High holding pressures under the bolster are necessary—approximately 30 lb. per sq. in. more than for steel and these pressures, in turn, call for the use of heavy chromium-steel draw-rings. If the component has tapered sides, "tear-drop" edges should be provided on the tools at points of stress, to avoid rupture of the vinyl. A "tear-drop" edge is also essential when trimming from the steel out to the vinyl.

Die lubrication is highly important. Mutton tallow, although costly, has proved excellent for this purpose. Compounds with a vegetable-oil base are less expensive substitutes and have the necessary fatty quality. Sulphur-base oils attack the vinyl, and must be avoided. Drawing speed is low compared with that employed for steel, and should be about 1 ft. per min.

Two typical press operations are illustrated in Fig. 6 and 7. Fig. 6 shows the drawing of the central section of a panel for the hump in a sports car floor. Later, the ends of the panel will be bent, and a centre opening punched, as in the finished piece seen on the display board in Fig. 1. Four different trimming operations on seat side shields for the same car are being performed on the press seen in Fig. 7.

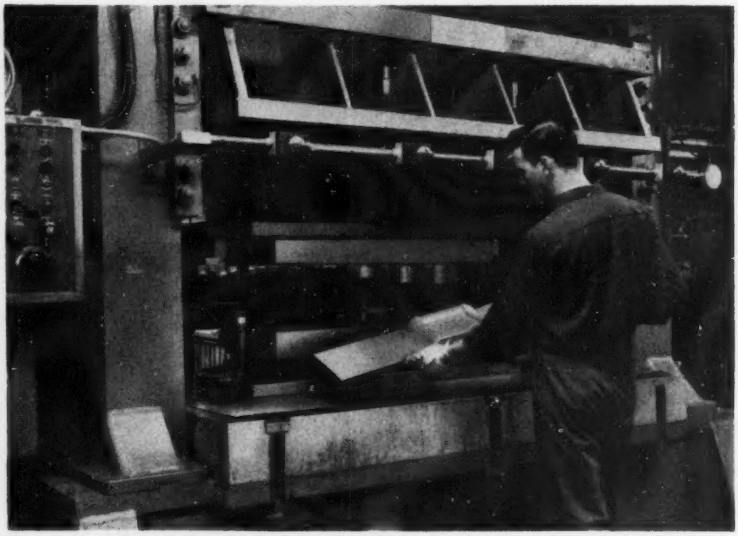


**Fig. 6. Sheared Blanks are Here being Drawn on a Bliss Straight-sided Mechanical Press. The Design is Such that Damage to the Vinyl is Avoided**

Fig. 7. Trimming Seat Side Shields on a Hamilton Press. "Teardrop" Edges are Provided on the Tools to Prevent Rupture of the Vinyl

## WELDED ASSEMBLIES ARE NOW PRACTICAL

Until recently, the single serious restriction on the product designer's use of the laminated materials has been the inability to resistance-weld clips, brackets, hinges, or other items to the steel backing without spoiling the vinyl. The difficulties will be obvious when it is considered that one side of the steel must be hot enough to melt, while the vinyl itself must not reach a temperature much exceeding that of boiling water.

Fig. 8. By Accurately Synchronizing Heat and Pressure Laminates can be Successfully Welded

The solution has been found in a projection-welding technique involving the use of magnetic force. Projections are provided in order to concentrate the heat. By substituting magnetic force for the usual hydraulic or pneumatic force to squeeze the parts together, heat and pressure can be accurately synchronized to a fraction of a cycle. Since the vinyl is an insulator, the current does not flow through it, as in ordinary resistance-welding techniques. Instead, it flows through the back of the laminate and the component that is to be attached to it.

A magnetic-force welder employed in the Arvin factory is shown in Fig. 8. Here, tempered steel clips are being projection-welded to the backing of a vinyl-steel laminate pressing which forms the front case of a portable radio. The machine was designed and built by the Precision Welder & Flexopress Corporation, and is equipped with Robitron controls. A 150-kVA transformer supplies the current for welding, and a 50-kVA transformer, the magnetic force. The welds show very satisfactory shear strength.

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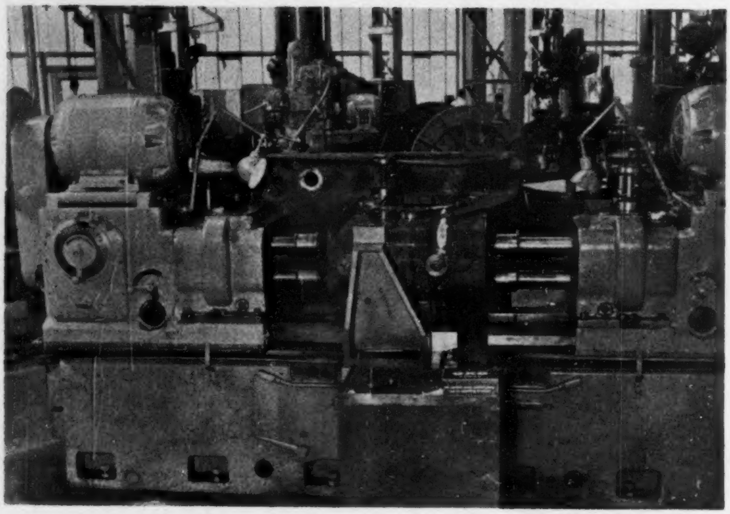
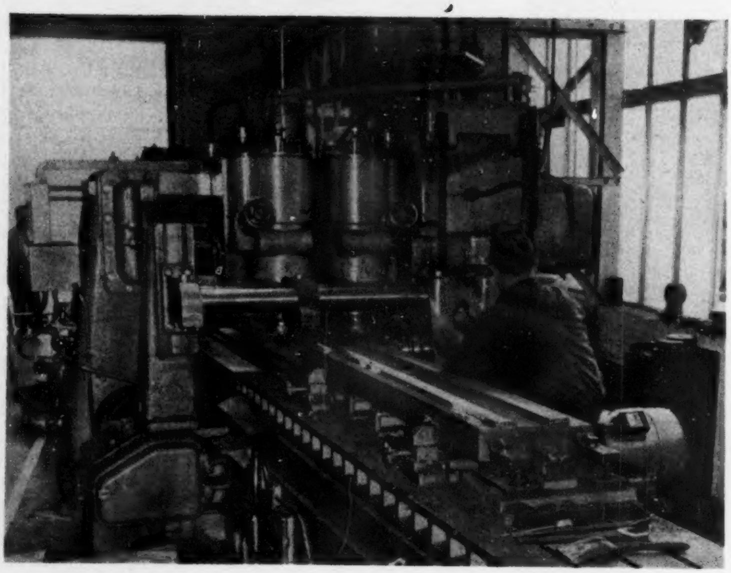
CORROSION-RESISTANT VALVES—A new range of valves which can be used for handling strong sulphuric and nitric acid, also hot ferric chloride, and will withstand temperatures up to 200 deg. C., has been developed by the Chemical Pipe and Vessel Co., Ltd., Kenley, Surrey. Of Fluon, the valves are made in sizes up to 2 in. bore, and the range includes fine-adjustment, pressure relief, on/off, and non-return types.

# Round the Shops

## Interesting Operations on Milling Machine of C.V.A. Jigs,



Boring the column of a CVA-Kearney & Trecker 3TF milling machine on special-purpose Kearney & Trecker, twin-head equipment. Each head has four cutter spindles, and tungsten carbide tippped tools are used throughout. Two spindles at the front of each head are fitted with special eccentrically adjustable tool bits, for boring the holes for the overarms 5 in. diameter, to a 0·0005-in. tolerance. The other spindles are fitted with Herbert Microbore tools for machining the main spindle bore to 6·750 in. — 0·0002 + 0·0003 in. diameter and counterboring it, and the layshaft bore to 4·330 in. diameter, + 0·0001 — 0·0008 in.

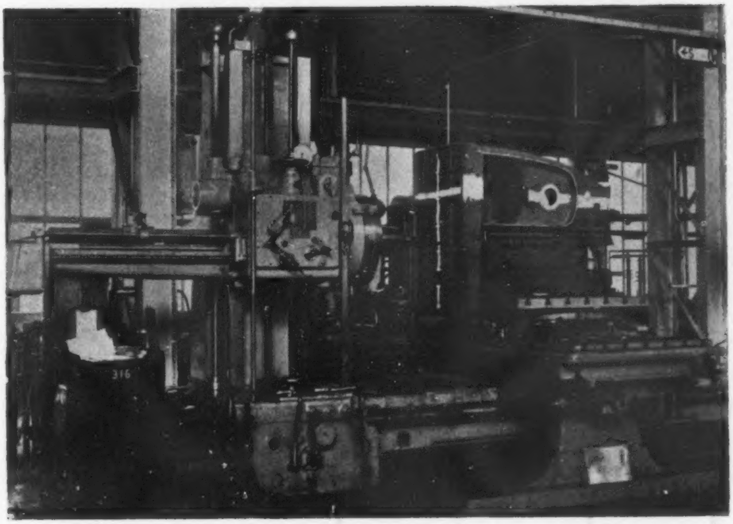


This special plano-milling machine has been built by the company for operations on milling machine tables. It has two 25-h.p. main motors, one for driving the two vertical heads, and the other for the horizontal head, and there is a separate 3-h.p. feed motor. The machine table moves on twin rectangular-section steel guideways, which are hardened and ground, and it is powered by a hydraulic cylinder. A Norgren oil-mist lubrication system is incorporated. The machine is seen rough milling one side face and the bottom faces of the dovetails on a table for a 3TF milling machine, tungsten carbide cutters being used for these operations

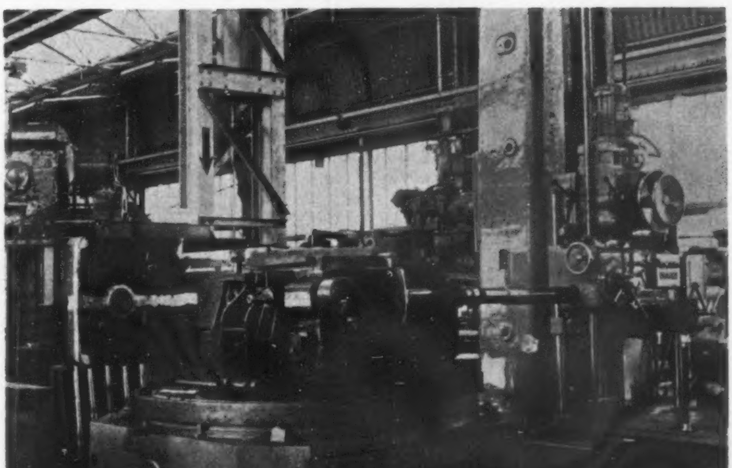
# with a Camera

## Components at the New Littlehampton Factory

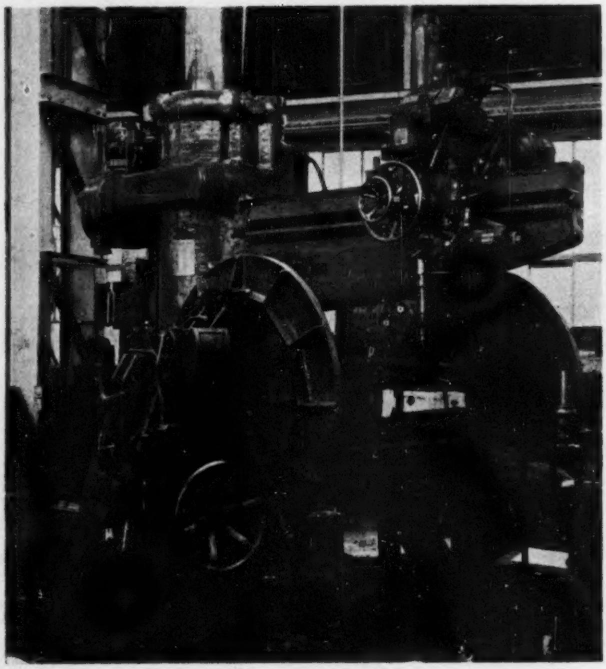
## Moulds & Tools, Ltd.



A column casting for a CVA-Kearney & Trecker 3CE horizontal milling machine is here seen set up on a Gilly 100 borer. At one loading, with the casting clamped on an indexing table, the seating face is milled on the base, the facings for the door on one side, and for the speed gearbox and feed gearbox on the other side, are machined, holes for expansion plugs and for the elevating screw are bored in the base, and the clamp pad holes are bored in the top of the column. Including loading and unloading, the operation sequence is completed in 7½ hours



For boring operations on the column castings of CVA-Kearney & Trecker 3CE vertical milling machines, a Kitchen & Wade travelling column, floor-type machine, fitted with a 6-ft. diameter, hand-operated indexing table, has been installed. At one set-up, with the casting mounted on its side in a special fixture, the bores for the gear shafts and the main spindle drive shafts are machined, in the front and rear sides and top of the casting. The floor-to-floor time for the complete boring sequence is 20¼ hours. Boring bars are stored in a special rack at the rear of the machine baseplate



A column casting for a 2CE milling machine is here shown being drilled in a large trunnion fixture, which is floor-mounted beneath the arm of an Asquith OD2 8-ft. radial drilling machine. With the work clamped in position between the two plates of the fixture, various holes are drilled with the aid of plate jigs, such as those seen at the left. The work and plates can be rotated by means of an electric motor drive, which is automatically cut out when the work is within 5 deg. of the required angular setting. It is then moved by hand, through a reduction gear, until it is finally located by an index plunger. With this equipment, four separate drilling set-ups have been eliminated, and the time now required for the complete drilling sequence is 8¼ hours

## Horsepower Required for Gun Drilling

The July issue of *Metal Cuttings,* the quarterly journal published by the National Twist Drill & Tool Co., Rochester, Michigan, U.S.A., was devoted to a discussion on the comparative power required for producing holes with twist drills and gun drills.

After briefly outlining the fundamental differences between the two processes, the article comments on the relationship of torque and metal removal in the case of a twist drill. Tests have revealed that drilling torque is not entirely proportional to the volume of metal removed per revolution of the drill, and, in fact, if the feed per revolution is doubled the torque is increased by only 1¾. Similarly, if the diameter of the drill is doubled, the torque will be increased by a factor of 3½ instead of 4.

The figures quoted above are then applied to gun drilling, an allowance being made for the fact that a gun drill has only one cutting edge, whereas a twist drill has two. Allowance is also made for the more conventional cutting action which is obtained with a gun drill, in that there is no chisel edge at the centre (as in the case of a twist drill), and that the efficiency of the tool is thereby increased. In addition, a considerable advantage is obtained from the fact that a copious supply of water- or oil-based cutting fluid is used when gun drilling, which has a tendency further to reduce the torque required.

A graph included in the article enables a comparison to be drawn between the energy required for drilling with a twist drill and a gun drill, both of ½-in. diameter, at feed rates of 0·008 and 0·001 in. per rev., respectively. Here, it may be seen that whereas the horsepower required per cu. in. of metal removed is slightly greater for gun drilling than for twist drilling, the torque is considerably less, being in the ratio of 1 to 7½.

A short section is devoted to the supply of cutting fluid during gun drilling, and the horsepower required to provide the large volumes and pressures which are necessary. It is pointed out, in conclusion, that although a gun drill is basically a more efficient cutting tool than a twist drill, the overall power requirements for the former are frequently greater than for the latter. On the other hand, gun drilling is often the most economical process as the accuracy, straightness, and finish of the holes produced by this method are such that finishing operations may be unnecessary.

# Tilghman's Shot Blasting Plant for Ships' Plates

Tilghman's, Ltd., Broadheath, Altrincham, Cheshire, have carried out extensive investigations in connection with the shot blasting of large steel plates for ships' hulls, as a means of removing mill scale, and producing an etched surface for painting. Improved bonding of paint results from this treatment, and, in consequence, corrosion of the plates when in service is greatly reduced.

As a result of this experimental work, the company has developed a range of shot blasting plants which incorporate 4, 6 and 8 centrifugal shot-projection units, and conveyors for handling the plates to be cleaned. Plants with one- and two-wheel shot projection units can also be supplied for treating comparatively small plates. For example, equipment with a single-wheel shot projection unit enables plates up to 6 ft. wide to be treated at a single pass. An oscillating motion is imparted to the stream of shot in order to cover the entire width of the plate, which is traversed at a fairly slow speed.

Shot blasting plants of the type shown in Fig. 1 have recently been supplied to Smiths Dock Co., Ltd., Middlesbrough, and J. L. Thompson & Sons, Ltd., Sunderland, and it is stated that they were the first to be brought into operation in this country. Housed in a central building, the shot blasting equipment measures 10 ft. long by 5 ft. wide by 14 ft. high, and has six shot-projection units which enable both sides of plates to be treated simultaneously. There are 2-ft. long baffle sections at both ends, and the plate is passed to the shot-blasting area by way of a drying chamber which ensures removal of any moisture from the surfaces to be cleaned. A spraying cabinet can be provided at the discharge end of the shot-blasting chamber, and here a rust inhibitor in the form of a non-aqueous transparent solution is applied to the cleaned plate. Only a very thin film of this solution is deposited, which dries in a few minutes at atmospheric temperature, and, it is stated, does not adversely affect any welding that may subsequently be carried out on the plate.

A 40-ft. long roller conveyor is provided at each end of the shot-blasting equipment, for supporting the work edgewise at an angle of 5 deg. from the vertical. Movement is imparted to the plate by motor-driven rolls in the floor of the shot-blasting chamber, and the traversing speed can be varied from 4 to 12 ft. per min. Fig. 2 is a close-up view of the conveyor at the discharge end, and a treated pla'e can be seen emerging from the building.

Each shot-projection unit is provided with a wheel which is driven at a speed of 2,250 r.p.m., and comprises two discs with spacing pieces between them. Eight renewable blades of special iron-alloy are secured to the distance pieces by screws, and provide for the radial discharge of shot, at high velocity, on to the work. From a storage hopper, abrasive is delivered by way of a pipe, to a small-diameter impeller secured to the shot-projection wheel, and is then passed to the centre of the wheel, where it is delivered tangentially to the blades, through a

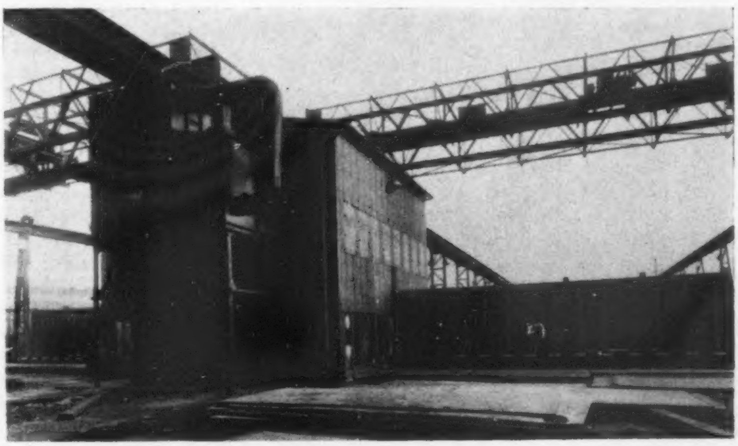


**Fig. 1. Tilghman's Shot Blasting Plant for Cleaning Ships' Plates**

slot in a unit known as a control cage. Provision is made for adjustment of the control cage, so that the abrasive may be discharged from the wheel at any point round its periphery.

Spent shot and debris is removed by a bucket elevator and discharged into a rotary sieve for the separation of fairly large pieces of mill scale. The abrasive is then passed through an "air-wash" unit, and here fine dust particles are removed and discharged into a fabric tube by low vacuum produced by a fan. Finally, usable shot is returned to the storage hopper. Dust collectors are also provided in the shot-blasting chamber and on the hoppers. The entire plant is controlled by push-buttons conveniently grouped on a desk at the front of the shot-blasting equipment. Various types of manipulators have been developed by the company to facilitate handling steel plates before and after shot blasting.

In Fig. 3 is shown a shot-blasting machine of a type which has also been supplied to the companies previously mentioned, for de-scaling sections and bulb angles. Several workpieces may be loaded side by side on the 42-in. wide horizontal roller conveyor which extends from both sides of the shot-blasting unit. The work is traversed at a speed of 6 ft. per min., and both sides are cleaned simultaneously by centrifugal shot-projection units mounted above and below the conveyor. An abrasive reclaiming system, installed under the conveyor at the discharge end, ensures that any particles of shot which are carried out by treated workpieces are recovered. A Tilghman's dust collecting system is provided for the removal of dust from the shot-blasting chamber.

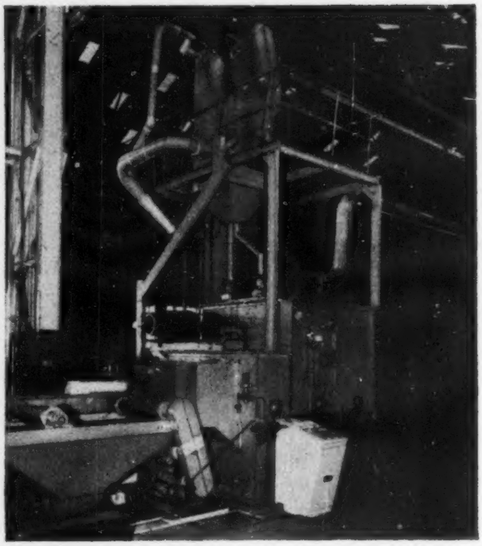


**Fig. 3. This Tilghman's Shot Blasting Plant is Intended for De-scaling Sections and Bulb Angles**

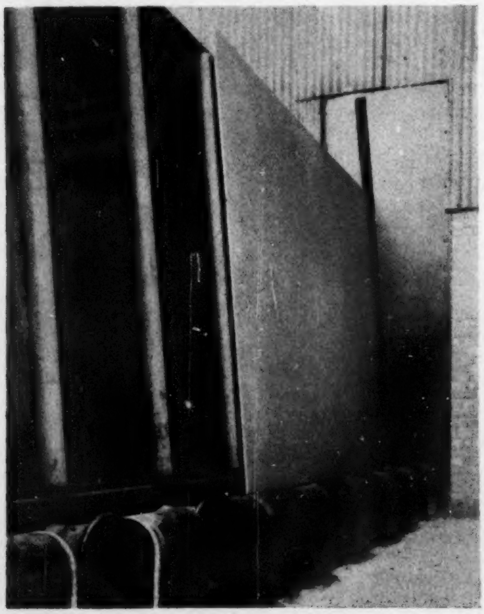


**Fig. 2. Close-up View of the Roller Conveyor at the Discharge End of the Plant Shown in Fig. 1**

Round, specially-treated cast steel shot in grades from S.110 to S.230, which corresponds to B.S.S.30 mesh, can be supplied for use with the machine. A separate spraying cabinet for the application of rust inhibitor solution is provided in the conveyor system at the discharge end.

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New P.V.C. Pastes—The Dunlop Compositions Division, Chester Road, Erdington, Birmingham, 24, have developed a new range of p.v.c. pastes, known as Plastisols, which are, basically, dispersions of fine p.v.c. powder in liquid plasticisers. Under the influence of heat, these pastes gel and solidify, to produce rubbery solids, without any appreciable reduction of the original volume. When painted on the open edges of a spot welded seam, on a motor car body, for example, the paste will set and seal the joint when the body is passed through a baking oven. Parts may also be coated by the hot-dipping technique.

# Continuous-casting of Tough Pitch Copper Slabs

The American Smelting and Refining Co. have recently installed, in their refinery at Perth Amboy, N.J., U.S.A., an electric furnace plant for continuously-casting the tough pitch copper slabs from which sheet and strip are subsequently rolled. With this plant, slabs up to 5 in. thick by 36 in. wide by 25 ft. long, weighing approximately 17,000 lb., can be cast at the rate of 20 in. per min. After they have cooled, the slabs are cut into lengths, suitable for the rolling mills, by means of a circular saw. These copper slabs were produced hitherto by the use of individual, water-cooled, steel moulds, and in order to obtain the degree of surface finish specified by the mills, it was necessary to cast them in the vertical position. This requirement imposed a limit on the length which could be cast, and the maximum size of mould cavity was normally 5 in. deep by 36 in. wide by 7 ft. 8 in. long. Such a mould produces a slab with an approximate weight of 3,000 lb. While slabs cast in this manner are satisfactory as regards surface finish, the limitation imposed on the length prevents the fullest advantage being taken of the high-speed rolling mills which are now available. The continuous-casting process provides a solution to the problem of producing longer slabs, and it is stated that copper cast in this manner is sound and dense, and has a surface suitable for rolling.

A cross-sectional view of the ladle, mould, and casting pit, is shown in Fig. 1. Pouring takes place at approximately ground level, and the slab is supported, as it emerges from the under-side of the mould, by a hydraulic ram. The casting is cooled, initially, by a series of water-spray jets, and it then enters the main cooling reservoir, the water level of which is some 3 ft. below the bottom face of the mould. The cooling water in the reservoir is continuously circulated by a pump, which has a capacity of 1,800 gal. per min., and there is a secondary 500 gal. per min. emergency pump which automatically comes into service should the main unit fail. This water cooling system has a heat dissipation value of 5,800 h.p.

An interesting feature of the installation is the design of the mould, which is only 15 in. deep. In order to prevent the slab from "sticking" as it passes through the orifice, the mould assembly is reciprocated as a complete unit. The stroke of reciprocation is very small and a speed of several hundred cycles per min. can be obtained, drive being taken from a variable-speed electric motor. Made from graphite, the mould is water-cooled, the heat-dissipation rate of the assembly being of the order of 1,500 h.p. Solidification of the case of the slab has already occurred when the leading end emerges from the mould, and the process continues as the casting, supported by the platform on the upper end of the hydraulic ram, is lowered into the water-filled cooling pit.

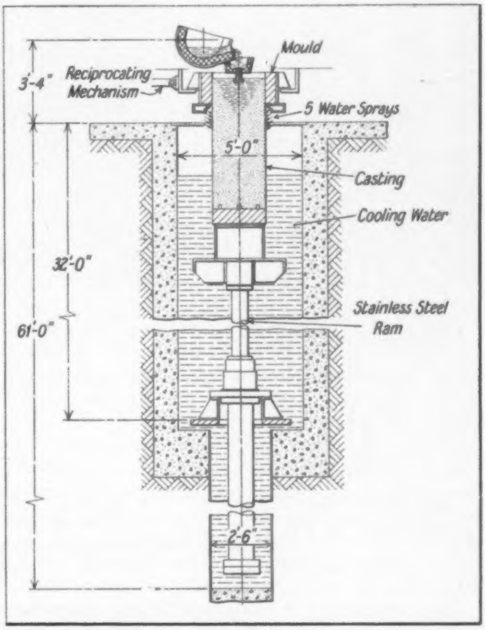


**Fig. 1. Cross-sectional View of the Ladle, Mould, and Cooling Pit of the Continuous-casting Plant for Copper Slabs which is Installed at the Works of the American Smelting & Refining Co.**

A view of the pouring station is given in Fig. 2, where the molten copper can be seen entering the ladle assembly, and discharging from the latter into a small pot positioned immediately above the

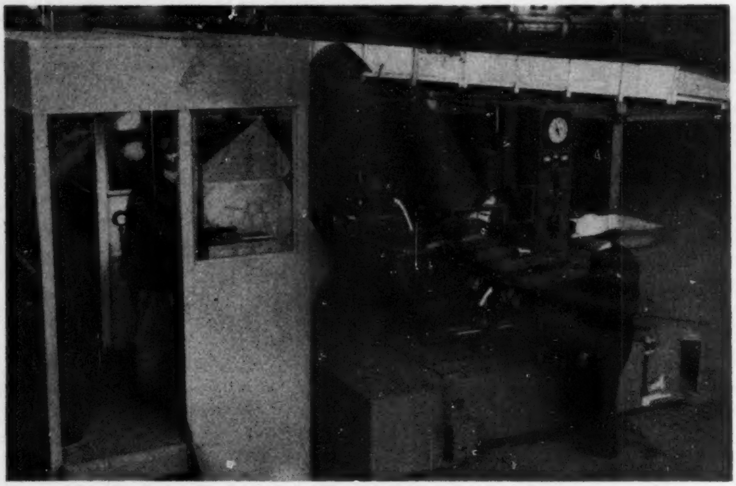

**Fig. 2. The Pouring Station of the Continuous-casting Plant. In the Background Can be Seen the 10-ton Capacity Holding Furnace from which the Molten Metal is Discharged to the Special Ladle, and Thence to the Water-cooled Graphite Mould**

mould orifice. At the left in this figure is the control cubicle, from which the speed of traverse of the supporting ram, the rate of pouring, and the functioning of the cooling system, can be controlled by one operator.

With a stroke of 27 ft., the stainless-steel support ram is hydraulically-operated and is completely immersed in the water contained in the cooling pit. The hydraulic circuit for this ram and cylinder is arranged so that the rate of traverse during casting is constant, regardless of the increasing weight which has to be supported as pouring proceeds.

The installation at the Perth Amboy plant comprises two moulds, placed side-by-side, which allow two slabs to be continuously-cast, simultaneously, at the rate of 20 in. per min. A direct-arc copper melting furnace, claimed to be the largest yet in use, is employed to melt the copper for the continuous-casting process, also billets and wire bar. The furnace bath has a capacity of 90 tons of molten copper, and is designed to melt copper cathodes at the rate of 30 tons per hour. Metal from the main furnace flows to a 10-ton capacity holding furnace, which is maintained at a temperature of 2,100 deg. F. This furnace, which is in the background in Fig. 2, has a spout from which the molten metal can be seen discharging into the special pouring ladle.

After the casting operation has been completed, the mould is swung to one side and the slab is withdrawn from the pit by a 10-ton overhead crane. Subsequently, the surface is inspected, and the slab is cut into lengths, suitable for the rolling mills, on a circular saw.

## Flame-Plated Pulleys for a Wire-drawing Machine

A leading manufacturer of cable in the U.S.A. has obtained a substantial reduction of operating costs by using aluminium guide pulleys which have been treated by the Linde Flame-Plating process. The pulleys are employed on a drawing machine, used to produce 0·020-in. diameter copper wire, and there is a total of seven sets of 5-in. diameter pulleys and their associated bearings. Aluminium was selected as the material to be used for these pulleys, as it provided the necessary resistance to corrosion, and, due to its low inertia, reduced the possibility of the wire breaking each time the machine was started and stopped.

In the untreated condition, the pulleys, which operate at speeds up to 5,000 r.p.m., had a working life of ten days, and the cost per pulley per day was 7 dollars. By using Flame-Plated pulleys, the working life is extended to 220 days, and the cost per pulley per day has been reduced to 0·70 dollars. Further savings result from reductions in maintenance costs and breakdown time.

The Linde Flame-Plating process, which was described in MACHINERY, 91/738—27/9/57, was developed by Linde Air Products Co., a division of the Union Carbide and Carbon Corporation, New York, U.S.A. The process is being operated in this country by John Harris Tools, Ltd., Miller Road, Warwick.

# Robinson Automated Machine for Trimming, Adzing and Boring Railway Sleepers

Thomas Robinson & Son, Ltd., Rochdale, Lancs., have recently developed the fully automated machine, shown in Fig. 1 and 2, for trimming, marking, adzing and boring railway sleepers at the rate of 10 per min. The machine is controlled by one man from a central panel, and has been designed to obviate stoppages due by occasional faulty sleepers.

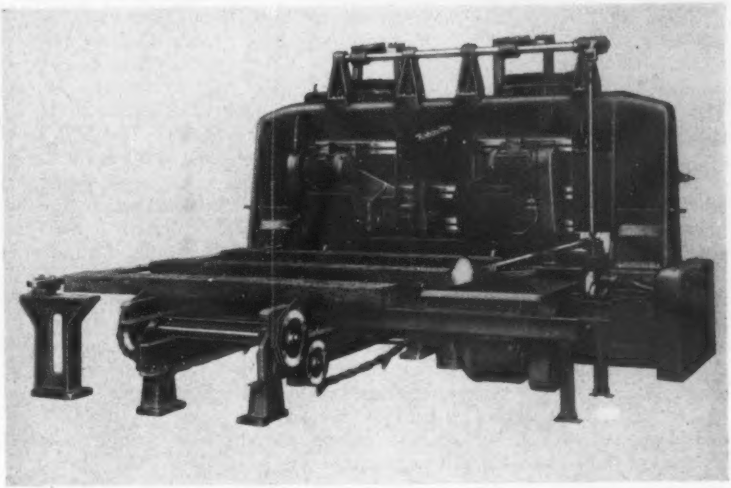

**Fig. 1. A View of the In-feed End of the Robinson Fully-automated Adzing and Boring Machine, Showing the Adzing Heads with the Marker Saw Between, and the Trimming Saw in the Foreground**

Conveyor chains feed sleepers into the machine where they are trimmed to length, trenched for the reception of the rail chairs, and bored for the holding-down spikes or bolts, in one continuous sequence. Sleepers for tracks of any gauge from 1 metre to 5 ft. 6 in. can be handled, with lengths from 6 to 9 ft., nominal widths of 8, 10 and 12 in., and nominal depths of 5 to 6 in. The machine can be incorporated in a flow production line, with sleeper handling equipment, and a Robinson timber incisor, which prepares all four sides of the sleepers for deep penetration of preservative. Infeed and outfeed conveyor speeds of the latter machine are arranged to provide an evenly spaced flow of sleepers to suit the production rate of the adzing and boring machine.

The adzer and borer is motor-driven throughout and comprises an in-feed conveyor, a cross-cut saw which can be mounted on either side of the conveyor according to requirements, main adzing and boring sections, feed mechanism, and an out-feed conveyor. Two steel chains, with dogs which project 2 in. above table level, provide for in-feed, the drive being taken from the machine feed gearbox through a Renold heavy-type chain.

An optional feature, the 24-in. diameter cross-cut saw for trimming the sleepers, is installed beside the in-feed conveyor in front of the adzing heads. It has horizontal adjustment to suit the length of sleepers, and pieces up to 2 ft. can be cut off. These ends are directed by an angled side fence to a large capacity storage space within the machine outline. A sawdust hopper, suitable for connection to an exhaust system, is included in the disposal arrangements. The saw spindle is mounted in ball bearings and is V-belt driven from a 10-h.p. motor.

While the subsequent operations are being performed on the sleepers, they are supported, under each adzing and boring unit, on separate flexible bed sections, with independent rise and fall, at each side of the machine. Provision is thus made for the irregularities and variations of warped or pit sawn sleepers, and endwise location is taken from a long side fence.

The bed sections are controlled by counterbalance weights, through plungers, and adjustable height stops for the plungers are set to suit the minimum thickness of the sleepers being handled.

Feed of the sleepers under the adzing and boring

heads is provided by reciprocating hinged dogs, which are actuated by crank disc, connecting rod and levers. Drive, from a 10-h.p. motor, is transmitted through V-ropes and a gearbox, the input shaft of which is mounted on ball bearings and carries a slipping clutch. There is an emergency brake for the feed drive, and when it is applied, the motor is automatically switched off.

Normally, there is one rate of feed, giving a maximum of 10 sleepers per min. for soft woods, or six sleepers per min. for hard woods, where suitable handling facilities are available. When both hard and soft wood sleepers are involved, change pulleys can be provided to give both rates of feed.

There are two independent, horizontally adjustable, adzing spindles, each mounted in ball bearings, and V-belt driven from a 10-h.p. motor, as seen in Fig. 1. Each spindle carries a solid 2-knife cutter-block with a normal cutting circle of 11 in. diameter, suitable for operations on chair seatings up to a maximum of 22 in. long. Cutters can be set for either horizontal or 1 in 20 angular seatings, and the form is such that clean shoulders are produced. Shoe-type guides, against which the top surface of the sleeper is held by the flexible bed sections, can be adjusted to enable adzed seatings of the required depth to be obtained.

Hinged combined exhaust hoods and cutter guards are provided, which have flexible nose-pieces to facilitate chip collection from the uneven top surfaces of the sleepers.

The two independent, horizontally adjustable, boring head units, shown in Fig. 2, may be set to bore any number of holes up to four at each end of the sleeper, either vertically or at an angle of 1 in 20. Ball-bearing spindles in each unit have universal joints and are adjustable for centre distances from 2½ to 6½ in. across the width of the sleeper, and from 4 to 17½ in. along the length. The joints are totally-enclosed in dust-proof, grease-packed covers. Each boring head unit is driven by V-belts from a 10-h.p. motor, through a ball-bearing gearbox. Feed and withdrawal movements of each unit, which are fully automatic, are controlled by cam, roller, levers and links, operating through an overhead rocking shaft. To ensure synchronism, the cam is carried on the same shaft as the crank disc for the reciprocating feed dogs. The ½-in. parallel shank augers are fed into the sleepers by the weight of the boring unit slide, with some spring assistance at the beginning of the operation, and withdrawal is positive.

Should undue resistance be encountered, for example, if an auger has broken, downward movement of the boring head ceases, but the operating cycle continues. If fewer than four holes are to be drilled by either boring unit, the surplus spindles with their universal joints can be readily removed.

Two fixed top guides are provided for locating the sleeper for boring. Each guide comprises three cast-iron brackets, to the under-side of which a wood slipper is attached. When a sleeper passes under the boring units, the adzed seatings are pressed against these slippers by the flexible bed. The length of the wood slippers is determined by the length of the seatings, and the brackets can be adjusted to suit.

Holes of the required size and spacing are drilled in the slippers, so that they can be employed as setting jigs for the augers. In addition, the slippers support the augers up to the point of entry into the sleepers. The top guides, it may be noted, form part of the exhaust hoods for the chips from the boring heads.

An automatic self-centring device is fitted to locate tapered or

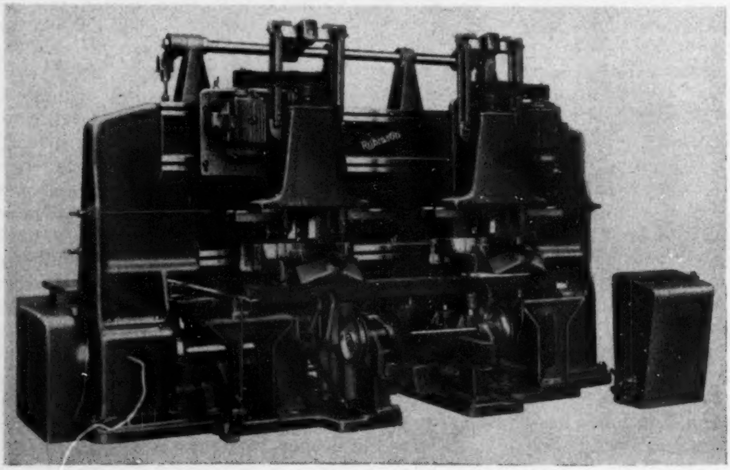

**Fig. 2. Out-feed End of the Robinson Adzing and Boring Machine, Showing the Boring Heads and the Control Panel on the Right**

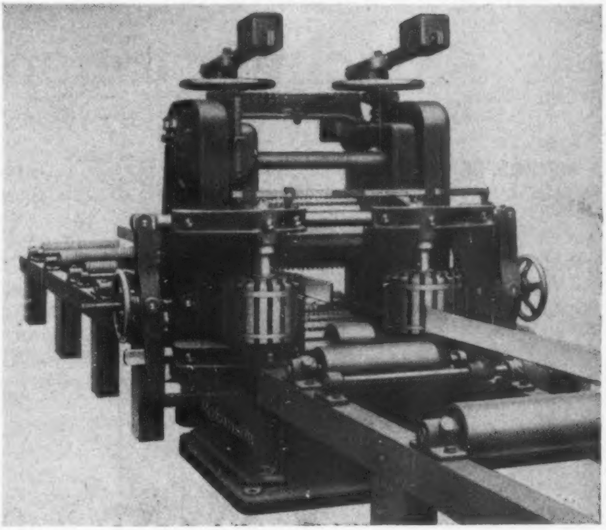

**Fig. 3. A View from the Out-feed End of the Robinson Timber Incisor**

varying-width sleepers centrally under the boring spindles. This device will centre sleepers from 7½ to 12½ in. wide, and comprises a cam, levers, rocking shaft, spring-loaded links, and scissor-arm quadrants. Its operation is synchronized with that of the reciprocating feed dogs.

Provision is made for mounting a small motor between the adzing cutter-heads to drive one or more saws for marking the top surfaces of sleepers with various combinations of grooves and spacings. The out-feed conveyor, which delivers the sleepers to a platform for transfer to creosoting bogies, is generally similar to the in-feed unit.

All the 10-h.p. motors are identical and interchangeable, and are of the totally-enclosed, fan-cooled, high-torque type.

### ROBINSON TIMBER INCISOR

Fig. 3 shows the timber incisor designed for piercing or incising the surfaces of timber in order to allow uniform diffusion and deep penetration of liquid preservatives, and to minimize checking and splitting by reducing surface tension. The incisions are ¾ in. long, spaced at 2¼ in. pitch, 1 in. apart, with ¼ in. stagger, and are made by a series of lances carried in four heavy rolls.

A feature of the machine is the flexible mounting of the top and bottom rolls and one side roll. This arrangement is particularly important for the top driving roll, as it ensures that the sleeper is firmly gripped during its passage through the machine, regardless of any irregularities in its dimensions. Pressure is applied through levers and adjustable weights.

Each incising roll is a solid steel forging with a series of longitudinal slots, in which the lances are clamped between distance pieces, and can be easily changed and replaced. The top roll only is power driven by double-duplex chains and spur gearing, and the lower roll, and both side rolls, are rotated by contact with the timber. The side roll, which is not flexibly mounted, has lateral adjustment, and is set in line with the fence.

A series of five chain-driven live rolls is provided at each end of the machine. The driving gearing is arranged so that the live rolls can be run either to give the same speed as the incising rolls when the machine is operating on heavy timbers, or a speed 50 per cent higher for lighter timbers, such as sleepers. When these rolls are run at the higher speed, each timber butts against the one in front when entering the incising rolls, and is quickly removed when the operation has been completed. The normal feed rate for sleepers and similar timber is 60 ft. per min., and for larger timbers, 30 ft. per min.

It is stated that timber incised on this machine has absorbed 40 per cent more preservative than untreated material from the same delivery.

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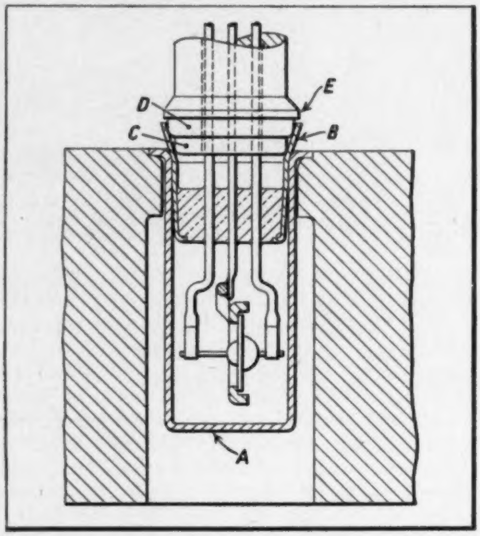
Deb Fire Extinguisher.—A small Aerosol fire extinguisher has been developed by Deb Chemical Proprietaries, Ltd., Forfar Chemical Works, Belper, Derbyshire, which is intended for installation alongside individual machines or work benches so that minor outbreaks of fire can be dealt with immediately. This extinguisher, which is known as the "Gwish," takes the form of a cylindrical canister which incorporates a discharge nozzle at the upper end.

The canister holds 12 fluid oz. of extinguishing liquid, and when the discharge nozzle is depressed a jet spray is released, which has a throw of 6 ft. and covers a circular area of 3-ft. diameter. The liquid used is electrically non-conductive, and may be employed for all types of fires.

# Machine Shop Patents

### A METHOD OF COLD-PRESSURE WELDING SMALL-DIAMETER COMPONENTS

The accompanying drawing shows a tool designed for cold-pressure welding small-diameter copper components, the example illustrated being the container of a transistor, and the parts which are to be joined being indicated at *A* and *B*. A flange on the part *A* engages with a recess in the die, and the part *B* has a flared portion at its upper end. Both these members must previously be annealed, and the inner and outer surfaces of the parts *A* and *B* must be mechanically cleaned.




**Sectional view of a tool for assembling a transistor container by cold-pressure welding**

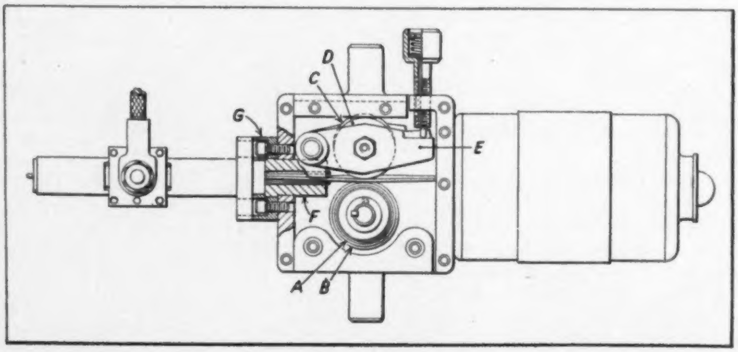
There are three diameter steps, *C*, *D*, and *E*, on the vertically-moving tool, and the diameter *D* is selected, in relation to the plain hole in the die, to ensure that the correct percentage reduction of the wall-thicknesses of the parts *A* and *B* is obtained. The diameter of the portion *C* is such that the diametral clearance between it and the hole in the die is approximately equal to the combined thicknesses of the parts *A* and *B*. A trimming-off operation is performed by the portion *E*.

During the first part of the downward movement of the tool, the tendency is for the flanges on the parts *A* and *B* to be straightened-out by the combined action of the steps *C* and *D*, and metal is extruded, upwards, past the edge of the step *E*. This process continues as the tool descends until finally the portion *E* trims-off the excess metal against the upper edge of the hole in the die. The tool ultimately pushes the entire assembly through the die.

784,939. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. [*Application date, August* 23, 1954. *Published, October* 23, 1957.]

### HEAD FOR CONTINUOUSLY-FEEDING TWO ARC-WELDING ELECTRODES

A motor-driven head, for continuously-feeding a pair of arc-welding electrodes, at different or identical rates, is shown in the accompanying drawing. The feed rollers *A* and *B* are driven by the con-




**Part-sectional view of a head for feeding two electrodes at the same or different rates**

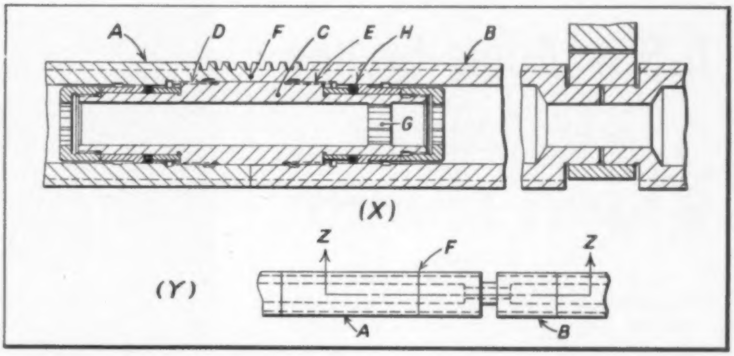
stant-speed electric motor and built-in reduction gearbox seen at the extreme right, and the electrodes are gripped between these rollers and the backing-up rollers *C* and *D*, which are carried by the pivoted arm *E*.

If the feed rollers *A* and *B* are of different diameters, the corresponding electrodes will be fed through at different rates. Alternatively, if the electrodes are required to be fed at similar rates, the diameters of the rollers *A*, *B*, *D* and *E* are made equal.

After leaving the feed rollers, the electrodes are passed through two guide members, *F*, which are insulated from each other, and thence through similar metal-lined guides in the nozzle, which are supplied with current by the terminals seen at the left of the figure. An insulating member *G* separates the guide members *F* from those in the nozzle of the unit.

With this arrangement, electrodes can be fed at different, but constant, rates, while being supplied, individually, with currents of different characteristics.

784,943. Braithwaite & Co., Engineers, Ltd., Church Road, Great Bookham, Surrey. [*Application date, November* 18, 1954. *Published October* 23, 1957.]




**Sectional and diagrammatic views of an arrangement for assembling and locking the various parts of a multi-section lead screw**

## ASSEMBLING LONG, MULTI-SECTION LEAD SCREWS

At *Y* in the figure is seen part of a long lead screw which is assembled from a number of threaded sections, and the view at *X* is a cross-section view showing how the parts are joined. Two types of threaded section are employed, comprising the plain tubular form *A* and the necked form *B*, which has provision at the centre for a plain bearing to support the screw and reduce the amount of sag caused by its weight.

In the view at *X*, which is a section taken on *Z-Z*, it will be seen that the parts *A* and *B* are bored to receive the hollow joining sleeve *C*. At each end of the parallel central portion of this sleeve there is a screw thread, as indicated at *D* and *E*. These threads are of different pitches, to provide a differential arrangement, and mate with corresponding threads in the parts *A* and *B*.

To assemble two threaded sections of the screw, the sleeve *C* is screwed into the part *B* until the end face *F* on the latter is positioned half way along the parallel portion of the sleeve. Next, the adjacent threaded section *A* is passed over the sleeve *C* until the threads *D* engage, and is then rotated until its end face comes into abutment with the part *B*.

The sleeve member *C* has an internally splined portion *G* into which a suitably-shaped wrench can be inserted, and by combined rotation of the sleeve *C* and the part *A*, continuity of the external thread form on the two sections can be obtained, with the end faces abutting. When this continuity has been obtained, the parts *A* and *B* are held while the sleeve *C* is rotated further, to provide opposed axial locking forces on the faces which are already in abutment.

A washer of compressible material as at *H* is provided at each end of the sleeve *C*, and by rotating the clamping rings at the ends of the sleeve these washers are expanded to exert radial locking forces between the sleeve and the threaded sections. The combination of axial and radial locking forces is sufficient to transmit the torque which will be applied to the screw under working conditions.

This arrangement for assembling and locking the various sections of a long lead screw eliminates the need for transverse taper pins, and when a hardened and ground screw is required, there is no necessity to leave parts of the threaded sections soft, for subsequent drilling and reaming on assembly.

799,848. Herbert Lindner, G.m.b.H., Lubarserstrasse 8-38, Berlin. [*Application date, May* 28, 1955. *Published, August* 13, 1958.]

# B.S.A. Acme-Gridley $\frac{7}{16}$-in. Capacity 6-spindle Automatic

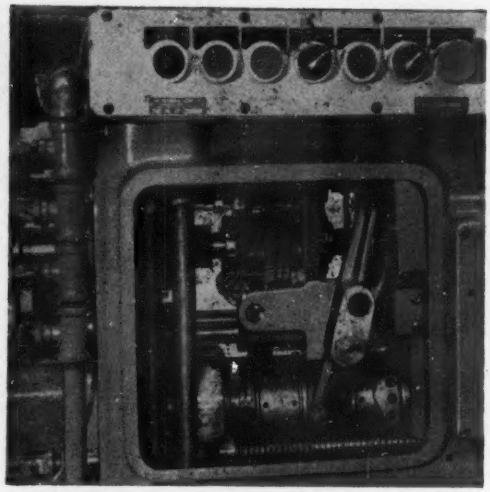


Fig. 2. Close-up View of the Gearbox with One of the Side Covers Removed

The recently-introduced $\frac{7}{16}$-in. capacity, 6-spindle bar automatic, type BRA6, shown in Fig. 1, is the smallest size in the B.S.A. Acme-Gridley range built by B.S.A. Tools, Ltd., Mackadown Lane, Kitts Green, Birmingham, 33. Bar feeds up to 3 in. are obtainable, and the maximum length that can be turned by end working tools is 2½ in.

Of rigid box design, the frame comprises the pan, headstock, gear box and one-piece top brace. Drive is taken from a 7½-h.p. motor mounted on top of the gear box, which gives spindle speeds from 758 to 4,770 r.p.m., and a wide range of feeds. Interchangeable gears are employed in the spindle and feed drives. An efficient braking system, in conjunction with large disc and roller clutches, permits rapid speed variations over a wide range at the beginning and the end of the non-working portion of the operating cycle, which occupies a period of 0·7 sec. Helical gears are employed for transmitting high speeds and heavy loads, and all shafts in the gear box run in anti-friction bearings. A close-up view of the gear box with the cover removed to show the cam-shaft for controlling the tool slide movements, is given in Fig. 2.

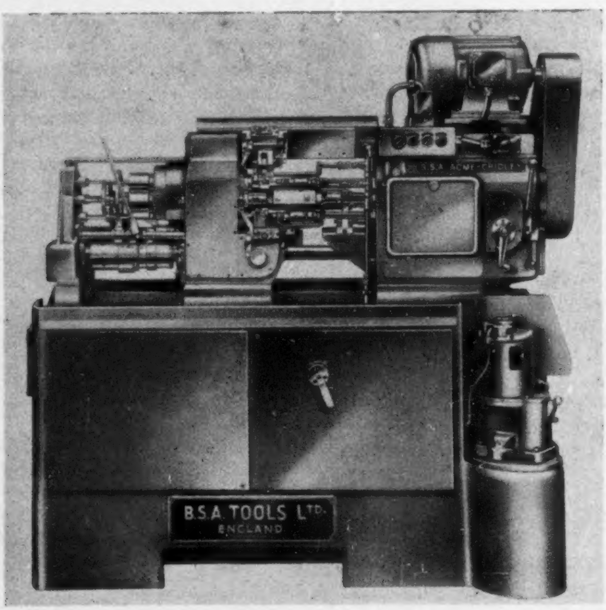



Fig. 1. B.S.A. Acme-Gridley, $\frac{7}{16}$-in. Capacity 6-spindle Bar Automatic

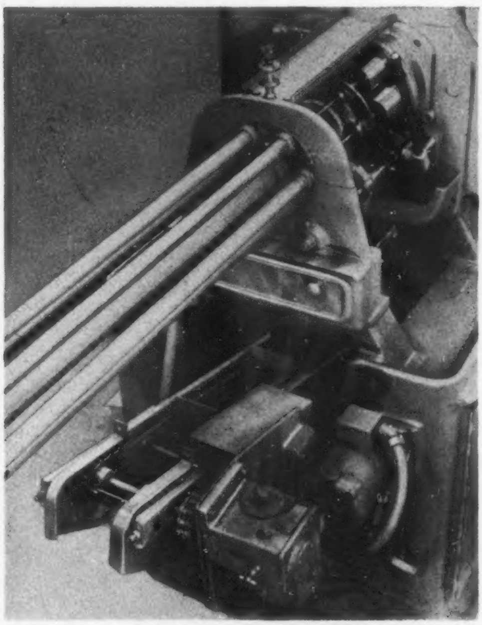
Anti-friction bearings are employed for the precision-ground spindles, and the carrier is indexed by a modified Geneva mechanism which ensures rapid motion without shock. Of hardened steel, the stem is ground externally, simultaneously with the journal for the spindle carrier, so that a high accuracy of alignment between the main tool slide and the spindles is ensured.

The stock feeding mechanism is carried by the headstock frame and an outboard support, which also houses the front end of the stock reel. Fig. 3 is a close-up view showing this arrangement, also part of a motor-driven swarf conveyor which can be supplied, if required. Independent

power indexing is provided for the reel through a separate shaft and gear. The chucking and feeding slides have long bearings on two large-diameter guide bars, and the chucking shoes have wide bearing surfaces on the spools, which are held in position by the housing for the spindle drive gears. A cam mechanism operates the fingers to close the collets, and rapid opening is obtained by centrifugal force. A hand-operated chucking mechanism with an automatic safety device is incorporated to enable bar ends to be removed when re-loading.

The main tool slide is guided by an arm which travels in a guide bracket attached to the gear box below the slide. A positive stop provides close control for depth and length for drilling and turning. High-speed drilling attachments may be employed at all spindle positions, and provision is normally made for threading at positions 3 and 4. If required, a threading attachment may also be fitted at the 5th position.

The cross-slides move on hardened steel ways, and are of robust construction to enable heavy cuts to be taken at high spindle speeds without



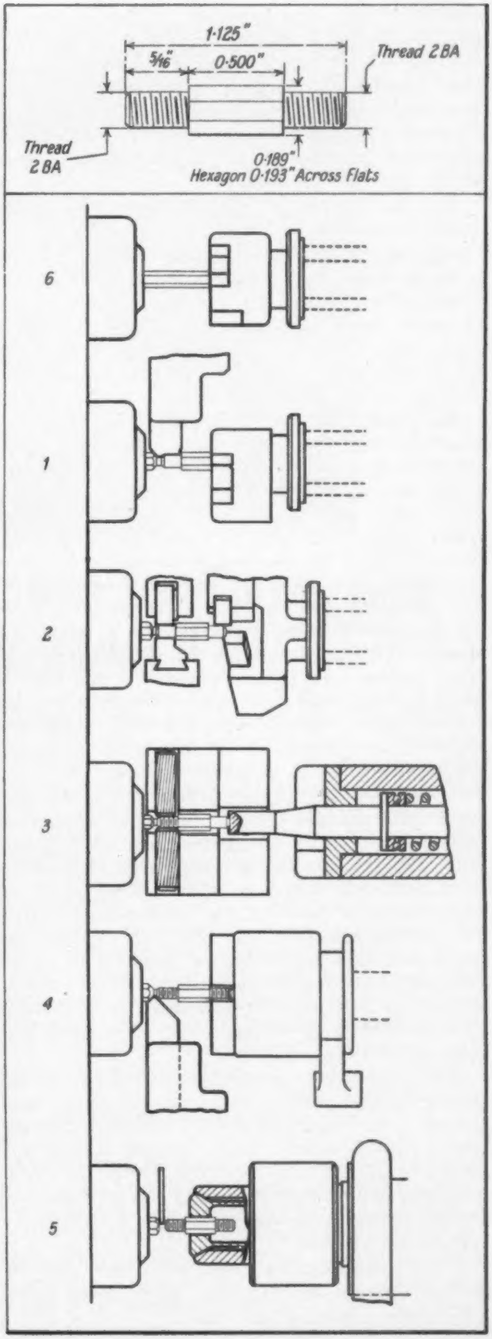



**Fig. 3. (above) A View of the Stock Feeding Mechanism and Swarf Conveyor**

**Fig. 4. (right) Tool Layout Diagram for Producing a Steel Spacing Stud from Hexagon Bar in a Cycle Time of 1·8 sec.**

chatter. Top slides mounted on the overarm at positions 3 and 4, and intermediate slides to take cutting tools or cross working attachments at positions 2 and 5, are available. The swing stock stop is carried in a long guide and moves upwards and forwards to its working position. A rapid return movement permits the use of end working tools at the bar feed position.

The machine, excluding the stock feed mechanism, occupies a floor space of 69 by 33 in., and weighs approximately 2 tons 5½ cwt.

As an indication of the productive capacity, it is stated that the spacing stud shown in Fig. 4, can be made from hexagon bar of En.IA steel in a cycle time of 1·8 sec. A spindle speed of 3,556 r.p.m. is employed, and the feed for the main tool slide is 0·0047 in. per rev.

At spindle position 6, the bar is fed out, and, when the stop has been brought clear, the thread diameter at the front end of the stud is turned by a box tool of the type normally employed on the B.S.A. No. 48 single-spindle automatic. A diameter of 0·163 in., plus an allowance for shaving, is machined at the rear end of the stud at the next spindle position. The flat form tool employed for this operation also produces a chamfered groove, the component being supported by a roller-type steady which engages with the previously-turned front portion. At spindle position 2, the stud is faced to length and chamfered at the front end, by a shank-type, roller support, box tool, which also supports the piece while shaving is being carried out on the 0·163-in. diameter portion.

A thread is formed on the rear end of the stud at the 3rd spindle position by a non-adjustable, geared-type thread rolling box, and during this operation, the component is supported at the front by a rotating cone-type collapsible steady. At the 4th position, a thread is cut on the front end of the stud by a Namco type DR $\frac{3}{16}$-in. capacity die head, and, simultaneously, the rear end is necked to facilitate parting off. In order to avoid forming a pip, the workpiece is supported by a rotating pick-up attachment while parting off is being carried out at spindle position 5.

When the pick-up attachment is brought into use during the next working cycle, the completed component is discharged, by contact with the following piece, through a tube which extends for the full length of the pick-up spindle. From the tube, it passes into a collector ring in the gearbox, and finally, through a second tube, into a tray at the side of the machine.

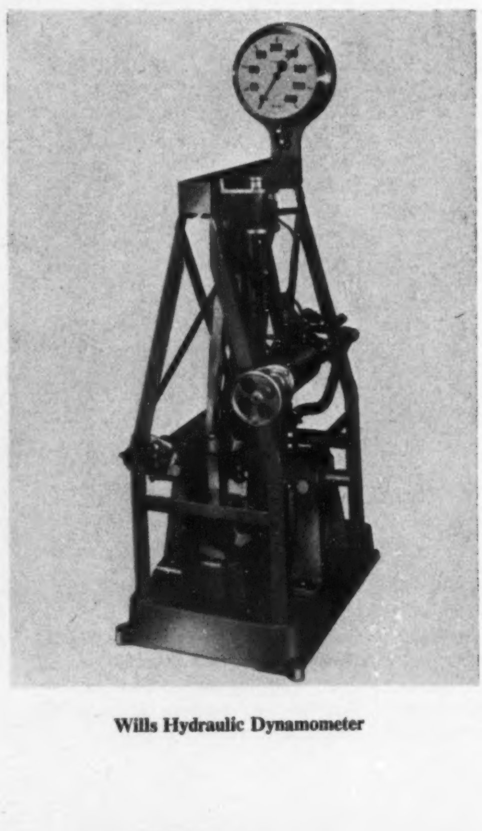
B.S.A. Acme-Gridley automatics are sold by Burton, Griffiths & Co., Ltd., Mackadown Lane, Kitts Green, Birmingham, 33.

## Wills Hydraulic Dynamometer

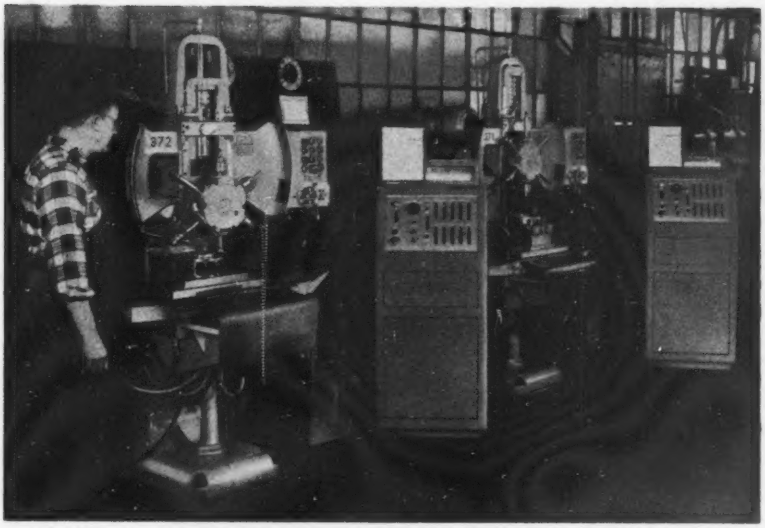
W. & F. Wills, Ltd., Bridgwater, Somerset, have recently introduced the hydraulically-operated dynamometer, here shown, for testing prime movers up to 15 h.p., with driving shafts which rotate in either direction, at a maximum speed of 1,500 r.p.m.

The machine to be tested is connected to a shaft which is mounted in ball and roller bearings and carries a water-cooled drum. When the machine has been started, brake shoes are brought into contact with the periphery of the drum, under a predetermined load, by the action of torque arms and a pair of plungers, to which pressure fluid is delivered by a handwheel-operated pump. The resulting movement of the torque arms causes a second pair of plungers to slide, with the result that fluid is displaced in a pipe connected to a large-diameter gauge, which gives readings for torque in ft./lb. values.

Water for cooling purposes is delivered to the drum from a mains supply, at 20 to 30 lb. per sq. in. pressure, and a flow valve is provided.



Wills Hydraulic Dynamometer



# Electropoint Control System for Turret-type Drilling Machines

Burgmaster turret-type drilling machines can now be run from a punched tape which can be prepared by a person without previous experience after only ten minutes instruction. Blueprint decimal information is punched directly into the tape. No electronic computer is required to establish the co-ordinate points necessary for programming operations, and no code book is required.

BURGMASTER-ELECTROPOINT PROGRAMMING SHEET PAGE 1 OF

FIRM: PART NO.

DEPT: BURGMASTER MODEL USED – 28HT 6 SPINDLE ☒ 28HT 8 SPINDLE ☐

OPERATION NO. TEST PART

| OPERATION LETTER OR NUMBER | OPERATION TO BE PERFORMED | CO-ORDINATES X-AXIS | CO-ORDINATES Y-AXIS | SPINDLE SEQUENCE | |
|---|---|---|---|---|---|
| A | 27/64 DRILL | 9.000 | 5.000 | 4 | |
| B | " | 8.000 | 5.000 | 4 | |
| C | " | 7.500 | 6.500 | 4 | |
| D | " | 9.000 | 6.000 | 4 | |
| E | " | 10.500 | 6.500 | 4 | |
| F | " | 10.000 | 5.000 | 4 | |
| G | " | 10.500 | 3.500 | 4 | |
| H | 27/64 DRILL and 7/16 REAM | 9.000 | 4.000 | 4 | 2 |
| B | 7/16 REAM | 8.000 | 5.000 | 2 | |
| D | " | 9.000 | 6.000 | 2 | |

**Fig. 1. This Programming Sheet Shows the Co-ordinates for Each Drilling Position and the Spindle Sequence Required**

This Electropoint system, as it is called, operates in conjunction with the two screws for the machine table movements, and it is claimed that it combines the accuracy of numerical techniques with the direct measurement provided by analogue devices.

The principle is one of continuous numerical measurement. There is no dependence on past movements, continuity of power supply, or the point at which the machine is started. It is possible to initiate an automatic programme from any position, to intersperse manual movements with tape control to re-start the automatic cycle at any point, and to operate indefinitely without returning to the reference position.

### PUNCHING THE MYLAR FILM

One method of preparing the data is to employ the centre of table travel as a reference position, and to write down the distance to each hole centre on the blueprint (or on a copy of it). A programming sheet, as shown in Fig. 1, is then prepared by entering details of the operation sequence, the *X* and *Y* co-ordinates, and the spindle sequence.

The tape, which is an endless belt of Mylar

film, is punched manually from the programming sheet information in binary coded decimal form in two parallel rows, one for the $X$ setting and one for the $Y$ setting of the table. In Fig. 2 are shown the simple punching apparatus and a partly programmed tape. Turret sequences for each table position, and other instructions such as "stop cycle," are punched at the end of each row. Five digit readings are displayed in both the $X$ row and the $Y$ row—two whole numbers up to 99, and three decimal places—so that each number of the five-place dimension has its own location.

Conversion tables are not required for preparing the tape. Only the decimal information from the part drawing is punched into the tape, together with holes in areas allocated to other machine functions, such as turret indexing. Tapes can be prepared in the shop office by anyone who understands machining operations, at an average rate of 1 min. per command block. (A command block consists of two lines of punched information, one for the $X$ axis and one for the $Y$ axis.)

Two standard Burgmaster 6-spindle turret drilling machines equipped with the Electropoint system are seen in the heading illustration. To the right of each machine is its console. These machines are installed at the works of the Clark Bros. C., Olean, N.Y., U.S.A.

A close-up view of a console is given in Fig. 3. On the front there is a vertically reading neon display panel which indicates the operation in progress and the table position for both the $X$ and $Y$ axes to an accuracy of 0·0005 in. The actual table position, and not the command position, is indicated, since the console is controlled by numerical measuring converters mechanically coupled to the table screws.

**Fig. 3. This Console Shows the Actual Table Position (to Three Decimal Places) and the Number of the Operation which is Being Performed**

A reader and command unit on the top of the console consists of a rotating drum which holds the tape, the latter being shown exposed in Fig. 4. As each drilling operation is completed, the tape can be advanced manually or automatically to bring a new command block into the operating position.

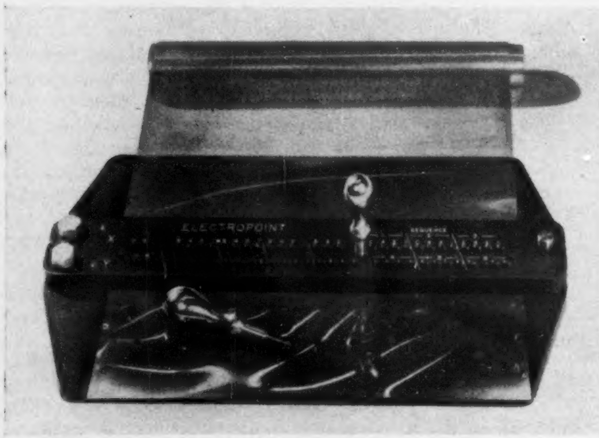



**Fig. 2. Decimal Numbers and Spindle Sequence Instructions Can be Punched Manually into the Tape in Approximately 1 min. per Command Block**

### THE CLOSED-LOOP SERVO SYSTEM FOR THE TABLE

Within the console, the output of the tape reader and the converters is subtracted by direct digit-to-digit matching. Current steps (position commands from the tape reader according to the error) are generated, and cause the table to move in a direction to match the command until the exact position is reached. Position commands are numerically compared with the position as measured by the screw and converter combination in the table.

The development of a polarity

signal causes power of the proper polarity to be applied to the driving-motor which then rotates the screw in the required direction to reduce the error. A closed-loop servo control is thus provided, and, regardless of the position of the table, the driving-motor rotates in the direction which will cause the difference between the command and table positions to be reduced to zero. Matching is accomplished by transistor switches rather than relays, so that an instantaneous comparison and error calculation can be effected.

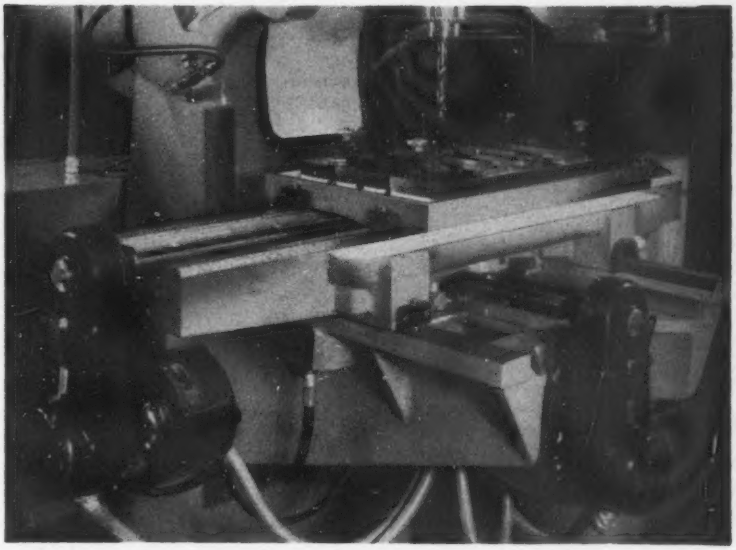


**Fig. 5. The Screws, which have a Lead Accuracy of 0·0005 in. per ft., Rotate in Anti-backlash Ball Nuts Attached to the Table**

Both table screws are of 0·2 in. pitch and of circulating-ball design, and the lead accuracy is 0·0005 in. per ft. At one end of each screw there is a drive-pulley, and the converter is connected at the other end. The arrangement is shown in Fig. 5.

Error voltage from the comparison unit is utilized by the servo control to govern the speed of the driving motor in such a fashion that little or no over-run occurs. A Warner electric brake provides for rapid stopping of the table, and since the servo control completes the closed loop, the table is always positioned accurately, irrespective of the direction of approach. The total balancing time is approximately 1 sec.

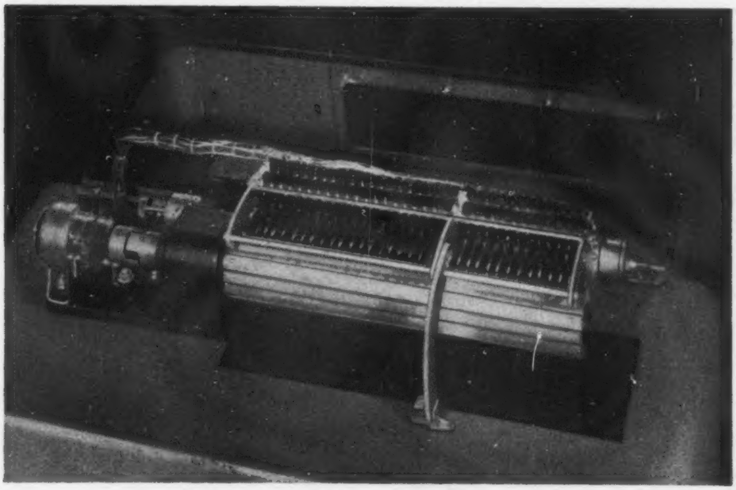


**Fig. 4. The Tape is Advanced Around this Reader, at the Top of the Console, as Each Drilling Operation is Completed**

Once positioned, the table is locked in place by air clamps for the machine operation. The turret-slide is locked until the table has been positioned, and it then performs a cycle of rapid approach, feed, rapid withdrawal, and automatic indexing. For each spindle, the feed-stroke is controlled by the setting of a micrometer stop on a vertical drum. These stops operate micro switches

which, through hydraulic valves, reverse the turret-slide.

There is a choice of four methods of machine operation: manually, with the tape reader disconnected, for setting up; semi-automatically, with the tape reader in use, but under full operator control, for checking out a new tape; automatically, with all functions controlled by the Electropoint system, for regular production; and finally, as a standard turret drill under automatic hydraulic control, with the console shut down.

Clark Bros.' experience affords an indication of the savings possible with the equipment. One man tends both machines, and the machining time for stop-plate valve parts has been reduced from 96 to 26 min. The parts are produced in batches of 50 to 200. Fixtures, costing approximately 500 dollars each, have been eliminated. The tape, prepared in three hours, controls the machine to hold the centre distance of the holes within the 0·0025-in. tolerance specified. In addition, the operator has time to inspect the work while the machines are running. The perforated tape is readily stored, and can be re-employed indefinitely.

Among other advantages claimed for the Burgmaster Electropoint system is the fact that drill and reamer bushings are not required. Changes in product design, moreover, can be readily accommodated by placing Cellophane tape over holes in the control tape, and punching in the new data in the manner already described.

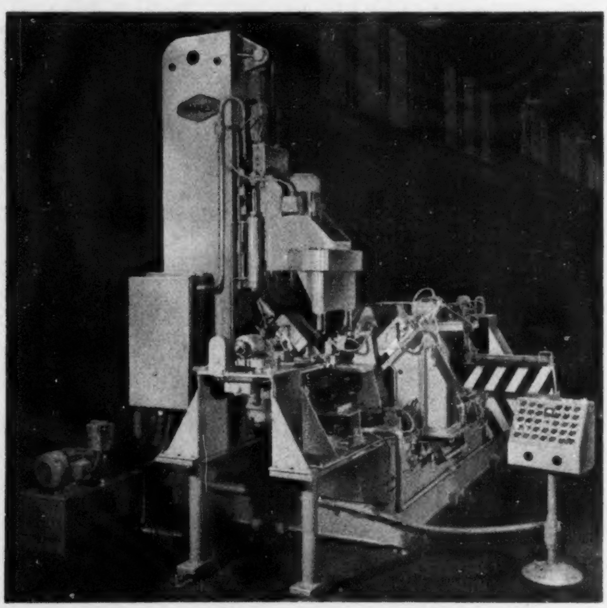
# Baker Inspection and Drilling Machine for Cylinder Blocks

The machine shown in the illustration has been built by Baker Brothers, Inc., Toledo, Ohio, U.S.A., for checking V-8 cylinder blocks for wall thickness, and for drilling and reaming two holes which are employed for locating the block during subsequent machining operations.

At the inspection stage, the block is checked for variations in wall thickness resulting from any movement of the cores for the cylinder bores and water jacket cavity during the casting operation. Provision is made for automatically checking such variations to close limits of accuracy, and for positioning the block for drilling the locating holes, so that when cylinder boring is carried out at a later stage, the wall thickness will not be less than a specified minimum value. If the variation is such that the minimum wall thickness could not be maintained at the cylinder boring stage, the block is rejected and is marked with paint for identification purposes.

In blocks such that the specified wall thickness can be maintained, the locating holes are next drilled by a vertical-spindle head. Upon completion of this operation, the block is moved horizontally to a second station where the holes are reamed. Finally, the block is automatically inverted in readiness for other further stages in the operation sequence.

Wickman, Ltd., Coventry, are the selling agents in this country for Baker Brothers, Inc.



**Baker Inspection and Drilling Machine for the Cylinder Blocks of V-8 Motor Car Engines**

# Thread and Form Rolling[1]

By D. H SEYMOUR[2] and F. M. LOMAS[3]

Thread rolling is essentially a cold forging process, in which the required thread form is impressed on the workpiece by rolling it between hard metal dies. Considerable deformation occurs during the operation, and strains of 200 per cent are reached in some regions of the thread section. Except that a very small amount of flaking sometimes occurs, no metal is lost during the operation.

The earliest rolled threads had poor mechanical properties because of limitations in materials and thread-rolling equipment. Threads which would satisfy exacting standards of accuracy, finish, and performance could not be rolled until materials with improved forming properties had been developed, and considerable improvements made in the design and construction of thread-rolling machines. Today, however, rolled threads are, in general, more reliable than machined threads.

In the past few years, successful efforts have been made to exploit the considerable economic and technical advantages of cold rolling in the production of a wide variety of forms other than screw threads, including gear teeth, splines, serrations, and knurled surfaces. Thread-rolling machines and attachments are also being increasingly employed for such operations as burnishing, straightening shafts and similar components, and forming annular rings and grooves. Substantial reductions in production times and costs have resulted from the application of these developments.

There has also been considerable extension in the range of materials to which thread rolling is being applied. Threads are now being rolled in most steels, including stainless-steel and tool steel, and in non-ferrous materials such as aluminium alloy, beryllium, nickel alloys, titanium, copper, brass, bronze, and some die casting alloys.

## FORMING PROPERTIES OF MATERIALS

Present knowledge indicates that there is no single property of a material which may be taken as an infallible measure of its rollability. It is generally accepted that a hardness of Rockwell C37 is approximately the economical maximum for thread rolling, but this figure should be treated with reserve as it takes no account of other physical properties or of the effect of thread form on the flow of metal.

An investigation[4] has recently been made of the thread-rolling characteristics of a number of materials, and it was found that the relative resistance to radial penetration could be predicted more accurately from ultimate tensile strength than from hardness. However, as the tangential rolling force was not measured in these experiments, it is possible that some modification of the results may be necessary when further investigations, which are now being carried out with improved apparatus, have been completed.

## DETERMINATION OF BLANK DIAMETER

As the volume of material in the workpiece is not changed during thread rolling, the accuracy of the finished thread is determined by that of the blank, and close control of blank diameter and roundness is essential for the production of accurate rolled threads.

In determining the diameter of a blank on which a thread is to be rolled, a small allowance, based on previous experience, or determined by trial and error, is usually added to the effective diameter of the finished thread. Wide differences of opinion are held in industry as to the value of this allowance. To resolve these differences, and to provide more reliable guidance in the specification of blank diameters, the P.E.R.A. investigation of 1956 was carried out to determine the size of blanks for rolling threads in a number of materials. The results showed that the diameters of blanks on which threads are to be rolled can be calculated with sufficient accuracy for most applications from the geometry of the basic thread form, provided that allowance is made for the effects of errors in pitch, flank angle, and thread depth which may exist in the thread-rolling dies. These errors are reproduced in the rolled thread and may result in the blank diameter required for fine threads being less that the effective diameter. Although some

1 Abstract of a paper presented at the Conference on Technology of Engineering Manufacture organised by the Institution of Mechanical Engineers.

2 Head of Technical Enquiry Service, Production Engineering Research Association.

3 Senior Engineer, Technical Enquiry Service, Production Engineering Research Association.

4 P.E.R.A. 1956 'Thread Rolling Diameters for Unified Screw Threads'.

flaking and consequent metal loss appeared to occur when rolling most materials, blank diameters determined from thread-rolling tests were substantially the same for the majority of the materials used in the tests.

The importance of allowing for the effects of thread form errors has not always been appreciated. The fit of a machined screw thread can be readily adjusted by altering the depth of cutting until the appropriate ring gauge can be assembled with the cut thread. Consequently, it is not essential for designers to consider the possible effects of individual errors in thread form on assembly. However, in the case of rolled threads, the blank must be machined to the correct diameter in a previous operation, usually on another machine. A correctly-dimensioned drawing of the blank cannot be prepared without a reliable method of calculating the required blank diameter. In the past, the necessity for determining this diameter by trial and error has often delayed production and increased manufacturing costs, but the results of the investigation mentioned above enable designers to specify correct blank diameters at the design stage, thus saving time and expense.

### EFFECT OF ROLL DIAMETER

The dies used in thread-rolling heads are considerably smaller in diameter than those used in standard thread-rolling machines, and the question frequently arises as to whether roll diameter affects roll life. So far as the authors are aware, no authoritative work has yet been done on this subject, but it appears reasonable to assume that, other conditions being equal, a decrease in roll diameter will result in decreased radial load on the rolls due to the reduced arc of contact. In this respect, the effect of roll diameter may be generally similar to that which occurs in strip rolling, although it is not known to what extent this effect is modified by reason of the fact that the thread rolls have grooved surfaces. The life of the dies is probably favourably influenced by the reduced penetration load. On the other hand, for a given speed of blank rotation and rate of die penetration, a point on the surface of a small-diameter roll will come into contact with the blank more frequently than a point on large roll. The number of stress cycles per component is thus increased, and fatigue, which is the most common cause of die failure, is consequently accelerated.

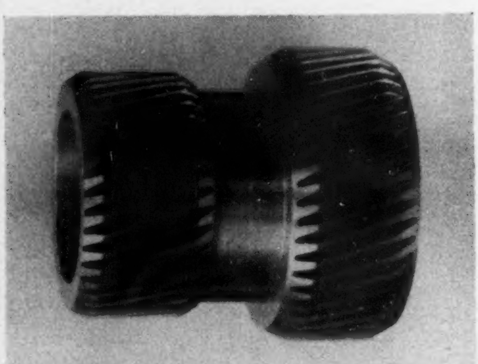


**Fig. 1. A stepped gear on which the helical teeth were roll-formed at two operations**

### APPLICATIONS OF THREAD ROLLING

The thread-rolling process is still mainly used for the production of screw threads, and in some factories as many as 10 hopper-fed flat die machines are operated by one man and an assistant.

Most rolled threads have a vee form, but Acme threads are now produced regularly by thread-rolling methods. An included flank angle of 29 deg. is normally regarded as the minimum for satisfactory rolling. It is claimed, however, that threads or forms with an included angle of 10 deg. have been rolled under favourable conditions.

A significant development in the production of screws has been the introduction of a patented process whereby a washer is automatically fed on to the shank of the screw before the thread is rolled. The increase in diameter due to rolling then makes the washer captive.

### WORM GEARS AND SIMILAR PARTS

Fuller application of the possibilities of the thread-rolling process has led to its application for the production of a variety of forms such as gear teeth and worms. The smaller, 40-tooth spiral gear shown in Fig. 1 was rolled in 20 sec., and the larger, 50-tooth gear in 30 sec. Each of these gears was rolled separately on a standard 12-die rolling machine. Two-stage rolling is normally necessary with stepped components since the blank rotation is derived from contact with the rolls and two different roll diameters cannot, therefore, be in engagement at the same time. It is, however, possible to roll stepped components, in one operation, by using cut-away dies with two sets of grooves which engage the work in turn, if the part is of sufficiently small diameter to make the necessary number of revolutions in less than one revolution of the die.

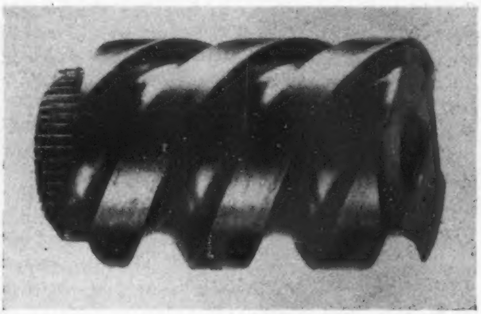


**Fig. 2. A clutch pressure spindle with a 3-start Acme thread produced by rolling**

Worm gears of a variety of forms are being rolled in many different materials. The clutch pressure spindle shown in Fig. 2 has an outside diameter of 20 mm. and is made from a case-hardening steel. The 3-start Acme thread was rolled in 30 sec. and the knurling operation was completed in 4 sec. Thread forms which require flat-crested dies for their production are difficult to roll, and it is common practice to radius the crests of the dies. This modification results in a rounded root, as seen in Fig. 2. The worm gear shown in Fig. 3 affords an example of the thin-walled components that can now be handled. The material is En.22 steel, and nine blanks at a time were mounted on a mandrel for rolling. For this operation, the rolling time was 15 sec. per component.

### SPLINES AND KNURLED SURFACES

Substantial economies are also being achieved by rolling splines. In one instance, a hobbing time of 2 min. was required for cutting splines on a $1\frac{3}{16}$-in. diameter shaft. On a special-purpose spline-rolling machine, the spline was produced in 4 sec.

**Fig. 3. This thin-walled helical gear was supported on a mandrel to prevent collapse during rolling**

Fig. 4 shows the working portion of the machine. It operates on the flat-die principle, and is equipped with long dies or racks. The involute form is generated on the component as it is traversed between the racks when the upper rack passes over the lower.

Standard thread-rolling machines are frequently used for knurling, and other machines can be adapted for the flat-die rolling technique.

### BURNISHING AND STRAIGHTENING

Burnishing and straightening are not strictly forming operations, since little or no plastic flow of the metal takes place. Both these operations, however, can be readily performed on thread-rolling machines. The stems of poppet valves, for example, are straightened between cylindrical dies with staggered lands. This operation is fully automatic, and stems are straightened at the rate of 1 per sec. Similar outputs can be obtained from flat-die rolling machines.

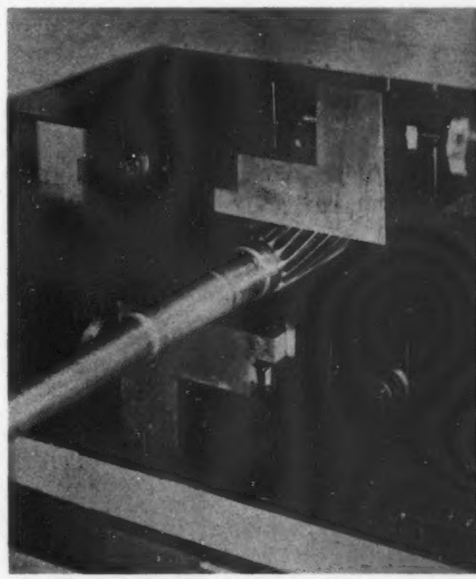


**Fig. 4. A close-up view showing spline-rolling dies and a component**

Shafts with journals burnished by rolling are shown in Fig. 5. The rolling operation produces a highly finished surface which is claimed to have improved wear resistance by virtue of the surface

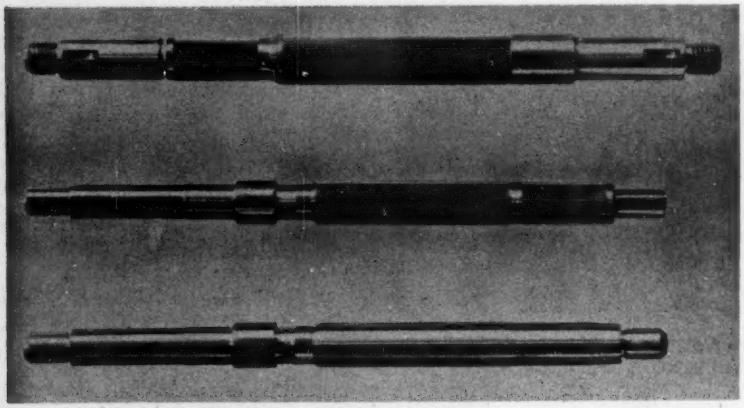


Fig. 5. Examples of shafts with journals which have been burnished by rolling

hardening which takes place. Components cannot be sized by rolling, as the metal is not significantly compressed nor does it flow axially.

### PLANETARY THREAD-ROLLING MACHINES

The production which can be achieved in thread-rolling operations has recently been greatly increased, to rates of the order of 38,000 components per hour, by the introduction of the planetary thread-rolling machine. A standard machine of this type has four moving dies, with convex working surfaces, mounted in a holder which rotates past two diametrically opposed stationary dies with concave working surfaces. The threads in the moving dies are concentric with the central spindle, whereas those in the stationary dies are inclined over approximately half their length, and thus penetrate the work gradually. Over the remainder of their length, the threads are parallel with those of the moving die, to ensure that the thread form is completely finished, and to improve the surface. A hopper at the leading end of each stationary die delivers one blank in advance of each moving die, so that eight blanks are fed during each machine cycle.

Production applications of planetary thread-rolling machines include the threading of components up to ½ in. diameter by 3 in. long, knurling and marking operations, and the forming of spiral nails. With mild-steel blanks, rates of output from this type of machine range from 9,000 parts per hour for ½-in. diameter threads, to approximately 20,000 parts per hour for ¼- and $\frac{5}{16}$-in. diameter threads. When threading small components, it is possible to employ a die holder with six stations, and higher outputs are then obtained.

### MULTI-OPERATION MACHINES

The increasing demand for mechanized production has resulted in the development of automatic machines incorporating thread-rolling units. A recently introduced stud-making machine, for example, is capable of producing threaded com-

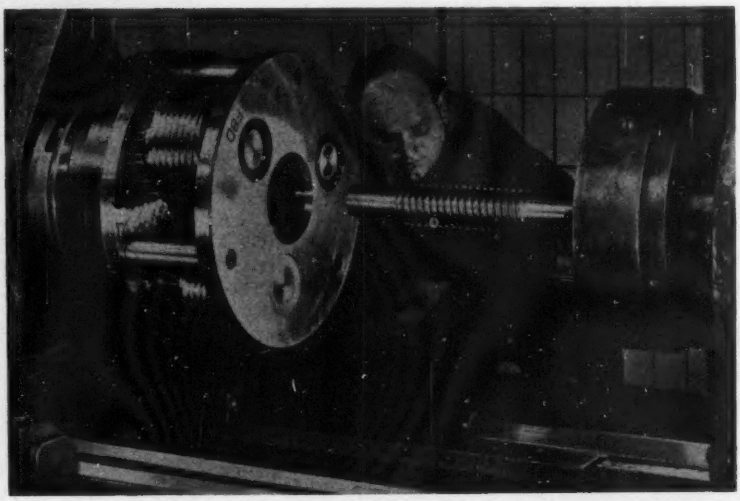


Fig. 6. A special head developed for rolling a 2-start Acme thread on a large-diameter spindle

ponents from 6 to 12 mm. (0·236 to 0·472 in.) diameter and from 25 to 170 mm. (0·984 to 6·69 in.) long. The machine consists of several units, through which the work is fed by means of a conveyor. In a typical production sequence, wire, from coil, is passed through a straightening unit and cropped to length. The ends of the cropped blanks are then reduced to the required diameter for thread rolling by extruding dies, and are subsequently pointed (or chamfered) by milling cutters. From this operation, the blanks pass to the rolling dies by ways of a cleansing bath which removes any swarf left by the pointing operation. Production rates for this machine range from 20 to 50 studs per min., depending upon the size.

Multi-operation sequences are also being performed on standard thread-rolling machines, equipped with specially designed rolls. In one instance, wire is cut to length and extruded on separate equipment, and the blanks are then hopper-fed to the dies, the ends are chamfered, the manufacturer's name is indented on the shank, and the thread is rolled.

### THREAD-ROLLING DIE HEADS

Thread-rolling is being increasingly employed during cycles of operations performed on standard machine tools such as capstan and turret lathes, and automatics. Two types of head are available for performing the rolling operation, one of which simulates the action of a thread-cutting die head and moves axially along the component. The other type is fed tangentially. As an example of the results obtainable with an axially-fed head, it may be noted that a $\frac{3}{8}$-in. diameter by $\frac{3}{4}$-in. long thread was rolled, in 3 sec., on a square-headed screw, made from 85-ton steel, which would quickly have destroyed the cutting edges of a screwing die. About 10,000 components of good finish and accuracy were rolled before it was necessary to regrind the rolling dies. Standard attachments of this type produce threads up to 2 in. diameter, and attachments of special design have been made for larger threads, such as the 3-in. diameter double-start Acme which is rolled on the component seen in Fig. 6. For multi-start and other coarse helix-angle threads, the attachments are fitted with helically-grooved rolls which are geared together in order to maintain them in the correct relationship.

### ACKNOWLEDGEMENT

The authors express their thanks to the Production Engineering Research Association for permission to use certain research results.

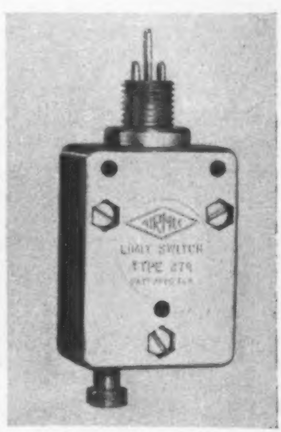
They also acknowledge the assistance received from various firms concerned with the supply and use of thread-rolling equipment, who co-operated in the preparation of the paper.

# Airmec Type 274 Limit Switch

The type 274 limit switch, of 0·5-amp., 250-volt rating, shown in the accompanying illustration, has been introduced by Airmec, Ltd., High Wycombe, Bucks., particularly for use on machine tools. It is of very simple and robust design, and the contact arrangement, which is the subject of a patent application, consists of a rocking magnet on which is mounted a single change-over assembly fitted with silver-palladium contacts. The magnet has only two stable positions so that snap action is obtained without the use of highly-stressed toggle springs. There is no possibility, therefore, of switch failure due to fatigue. The arrangement is such that there is no mechanical contact between the plunger and the contact assembly, and the latter can thus be housed in a sealed part of the case without the need for protection by bellows.

The plunger travel before operation is approximately 0·08 in., and the permissible over-travel after operation, $\frac{1}{8}$ in. A pressure of 12 oz. is required to operate the switch, and repeatability of the operating point is stated to be within $\pm 0{\cdot}002$ in. The maximum permissible rate of operation for the switch is three times per sec.

Measuring 2 by $1\frac{7}{16}$ by $\frac{7}{8}$ in., the switch case is of die cast light alloy, and three connections are brought out through a moulded bush contained in a brass collar, which is threaded $\frac{1}{2}$-in. conduit to receive a standard type of cable coupling.



**Airmec Type 274 Limit Switch**

# Reactron Bar Shearing Machine

Broadway Equipment, Ltd., 194-196 Finchley Road, London, N.W. 3, have recently been appointed sole agents in this country for the Reactron bar shearing machine, which has been introduced by the French firm of Soleco for use on the harder metals, such as alloy steels. It will also handle foundry bronze, for example, but is not intended for cutting soft metals such as aluminium and magnesium. The machine is available in two sizes, designated T20 and T40, which have capacities for shearing steel bars up to 1 and 2 in. diameter, where the tensile strength does not exceed 50 tons per sq. in., and bars up to ¾ and 1½ in. diameter, with tensile strengths up to 100 tons per sq. in. Fig. 1 is a front view of the T40 machine.

The stock is passed through apertures in substantial, vertically-mounted, bolster plates and is supported by the vee profile of a diabolo-shaped roller. Axial location is provided by a stop pin, which can be adjusted along horizontal guide bars at the rear of the machine. When a pedal is depressed, cutting is effected by the combined shearing and twisting action of two pairs of split dies, with a radius corresponding to that of the bar, which are brought into engagement with the stock at each side of the shear point. These dies can be readily removed and replaced by others of different radius or cross-sectional shape to suit the stock to be handled.

A view of the separated halves of the patented gripping and shearing mechanism, showing the dies, is given in Fig. 2. In operation, downward movement of the connecting rod *A*, causes the lower surface of the pivoted wedge *B*, to slide along an inclined face of the roller member *C*. A curved surface at the top of the wedge is thus forced against the under-side of the split die *D*, and the stock is tightly gripped. Continued downward travel of the connecting rod imparts a slight rotary movement through to the roller member *C* and the split die. Initial movement

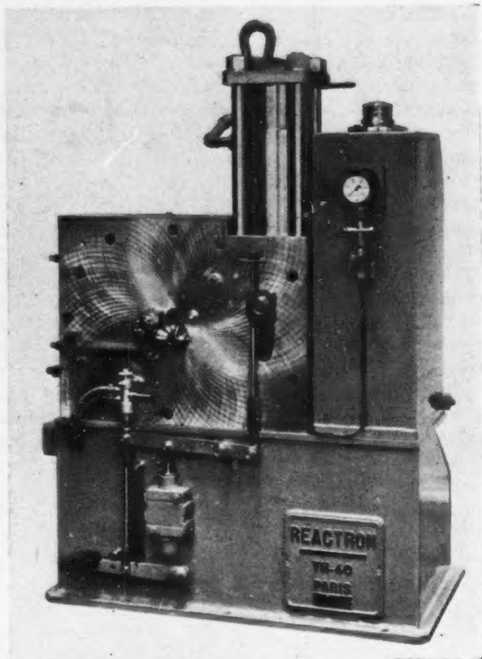



**Fig. 1. Front view of the Reactron type T40 bar shearing machine**

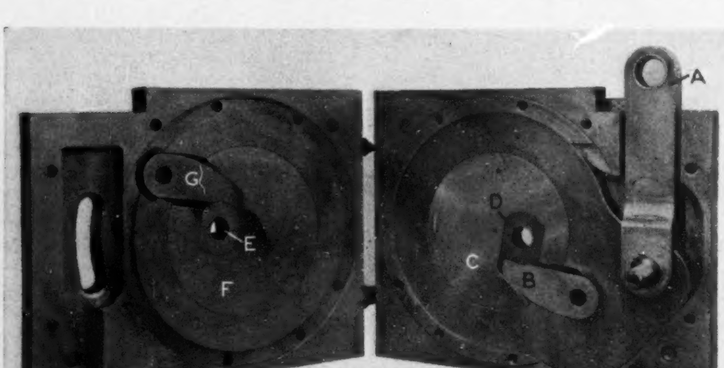
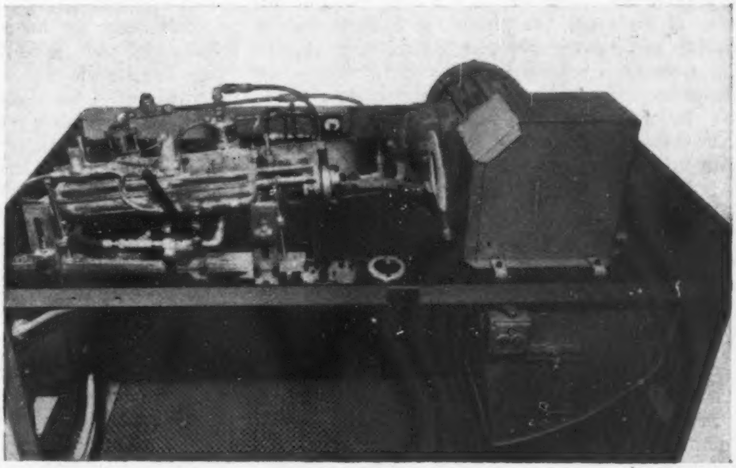



**Fig. 2. The patented gripping and shearing mechanism of the Reactron bar shearing machine**

of the die *D* is transmitted by the stock through the lower half of the split die *E*, to the roller member *F*, and rotation of the latter forces the wedge *G* against the upper member of the die *E*, with the result that the stock is tightly gripped by this die also. The die and roller assembly on the left in the figure is permitted to move sufficiently to enable the stock to be gripped, but further rotation is prevented by the wedge *G*, which, unlike the wedge *B*, is pivoted at a fixed point in the bolster plate so that it cannot move bodily about the axis of the roller member. Further movement of the right-hand wedge, die, and roller assembly, to the final position shown, then results in the stock being sheared. Movement is imparted to the connecting rod by the ram of a hydraulic cylinder, to which oil is supplied at medium pressure by a gear pump. A motor of 5 or 8 h.p. is employed for the pump drive according to the size of the machine.

During the operation, the gripping force applied by the dies increases in proportion to the resistance of the bar to shearing, and risk of damage to the dies due to the stock slipping is thus reduced. When the bar has been sheared, the pedal is automatically returned to the starting position by a control valve and the gripping mechanism is re-set by spring action.

It is stated that when shearing steel with a tensile strength of 80 tons per sq. in., some 20,000 cuts can normally be made before the dies require to be re-sharpened.



**Schrader air-operated semi-automatic buffing machine for tyre valve flanges**

## Schrader Air-operated Buffing Machine for Tyre Valve Flanges

The semi-automatic machine, here illustrated, provides for buffing the rubber flange attached to the stem of an air valve for a motor car tyre, in preparation for bonding the assembly to the inner tube. It has been built up mainly from items in the standard range of compressed air equipment made by A. Schrader's Son, 829 Tyburn Road, Erdington, Birmingham, 24, and is employed in the production of the company's range of tyre valves.

Buffing is carried out with a motor-driven wire brush housed in a sheet-metal cabinet at the right-hand end of the base. The workpiece is loaded into a holder attached to the right-hand end of the hollow piston rod of a 2¼-in. bore double-acting air cylinder, which is inclined at a small angle. This holder has a central bore to take the valve stem, and the diameter of the end face is approximately the same as that of the rubber flange so that the latter is fully supported during the buffing operation.

The stroke of the air cylinder can be adjusted from 11⅛ to 12 in., and when the automatic working cycle is started, by means of a lever-operated air valve, the piston rod is advanced, to bring the rubber flange into engagement with the wire brush. Since the stem is not gripped by the work holder, the rubber flange can turn freely under the action of the wire brush so that the entire surface area is buffed. At the left-hand end of the buffing head there is a safety guard in the form of a hinged plate with a central hole, through which the work holder is passed while it is being traversed towards the wire brush. Movement of this plate, due to interference by the operator's hand for example, when the work is being advanced towards the buffing head, results in operation of an air valve in the control system, whereby the piston rod is automatically returned to its starting position.

The actual buffing period is pre-set by means

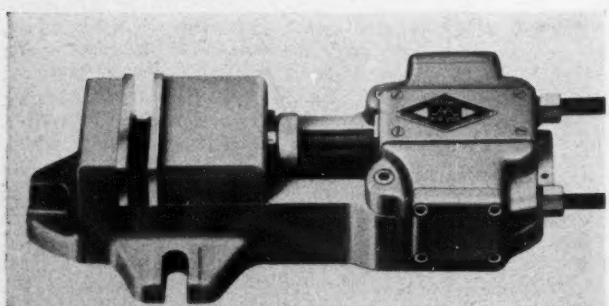
of another air valve, and at the completion of this stage of the cycle, the piston rod is automatically moved away from the wire brush. During the return stroke, a separate valve is operated to admit compressed air to the bore of the hollow piston rod, by way of a plate at the right-hand end of the cylinder, for a pre-set period, and the work is automatically ejected from the holder. The piston rod is held in the retracted position for a predetermined period, which is controlled by another valve in the compressed air system, while a fresh component is being loaded, and the cycle is then automatically repeated.

## Pneugrip No. 250 Air-operated Machine Vice

Air Automation, 26 Sharrocks Street, Wolverhampton, have recently placed on the market, the Pneugrip No. 250 air-operated machine vice shown.

Interchangeable 2½-in. wide by 1-in. deep jaw plates can be fitted for gripping workpieces of different shapes. A maximum jaw opening of 1½-in. is obtainable, adjustment to suit the workpiece thickness being made by a screw and nut. When the required setting has been obtained, the nut is secured by two cap-type screws. Since the working stroke of the moving jaw is only 3/16 in., the risk of trapping of the operator's fingers is virtually eliminated. A clamping force exceeding 1,350 lb. is applied to the work by an air-operated toggle mechanism, which obviates the risk of accidental release in the event of failure of the compressed air supply. The toggle mechanism is power-operated in both directions, and since thrust is applied directly to the rear face of the moving jaw there is no tendency to lift the work, and wear of the sliding surfaces is reduced.

Movement of the sliding jaw is controlled by a lever-actuated 4-way valve which may be attached to the body, or mounted separately for remote operation. If required, a ⅛-in. diameter copper pipe can be connected to the exhaust port of the control valve, for directing compressed air on to the jaws to remove swarf when the workpiece is released. The subject of a patent application, the vice occupies a space of only 10½ by 4½ in., and has an overall height of 2¾ in. If required it can be employed on a machine incorporating an indexing table and arranged for automatic operation, in sequence with other movements, to provide for clamping, release and ejection of workpieces.



Pneugrip No. 250 air-operated machine vice

## Automatic Control for Tool-room Work

(*Continued from page* 631)

machined under automatic control, programming occupied 16 hours, and the total time needed for the preparation of the magnetic tape was 23 hours. Machining, however, was completed in only 8 hours, and, by reason of the greater accuracy and better finish obtained, 2 hours sufficed for subsequent bench work, so that the total time was 33 hours. In this connection, it will be noted that whereas the overall times were in the ratio of approximately 3:1, the proportional saving in machine time was very much greater.

With economies of this order in prospect, automation in the tool-room, for such operations as jig boring, die sinking, and the machining of templates and cams, may frequently prove to be no less important than in the production departments. It may often be found, moreover, that ability to produce intricate tools more cheaply will enable the applications of such effective processes as die casting and plastics moulding to be extended to cover shorter runs than have hitherto been practical.

Large Carbon Electrodes.—The Union Carbide International Company, New York, U.S.A., have developed a 5-ft. diameter carbon electrode which weighs 10 tons, in anticipation of future demands for electrodes, for use with extra-large submerged arc furances, now in course of design. These furnaces will be used for production in the chemical and steel industries, and the heavy electric current employed (in the region of 50,000 kVA) will be carried by three large carbon electrodes, each 110 in. long.

# News of the Industry

## *Tyneside*

ARMSTRONG WHITWORTH (METAL INDUSTRIES), LTD., Close Works, Gateshead, have an extensive variety of work in hand, and a new bay has recently been added to the roll department to meet the large demand for Closeloy rolls. There is a steady call for refined pig-iron, and spheroidal-graphite iron castings for various applications are prominent in the foundry. We may note various sizes of Beier steplessly-variable gear reduction units and Eupex flexible couplings in progress. Other active lines include oilfield drilling equipment built for the Oil Well Supply Co., Ltd., and Kue-Ken jaw and gyratory crushers. A No. 95 Kue-Ken jaw crusher is to be shown at the Public Works Exhibition to be held in Olympia, London, from November 10 to 15. A second 6 in. spindle horizontal milling and boring machine built at these works, by arrangement with Noble & Lund, Ltd., Felling-on-Tyne, has recently been added to plant, and is being used for milling palm-ends, spade ends and keyways in rolls. Activity is steadily maintained at the firm's Tyne Street works, where railway axle boxes and other engineering components are produced.

The associated JARROW METAL INDUSTRIES, LTD., Jarrow-on-Tyne, are well employed on the production of castings, in carbon, alloy and manganese steels, ranging in weight up to 35 tons. These castings include a variety of marine components, turbine casings, sea valves, gearcases and press frames.

CLARKE, CHAPMAN & CO., LTD., Gateshead, are busily engaged in all departments. Orders are in hand for water-tube boilers, coal pulverizing plants and conveyors for power station use, as well as for boiler drums and tube elements for heat exchangers for the nuclear power plant at Bradwell, for which special mechanical handling equipment has been developed. A lively demand is maintained for ships' deck machinery, including electric and special winches, capstans, windlasses and cargo oil pumps. There is marked activity in the steel fabrication shop, where a variety of fusion-welded pressure vessels and general fabrication work are in hand. Extensions are in progress in the foundry, where spheroidal-graphite iron castings are being produced, and new cupolas and conveyor equipment for mechanical handling are being installed. A steady call is reported for searchlights, also mine and industrial lighting equipment. Recent additions to plant include a Richards 7-ft. vertical boring and turning mill and an Archdale 4-in. spindle vertical drilling machine.

WRIGHT, ANDERSON & CO., LTD., Gateshead, are occupied on a variety of structural steelwork, comprising steel-framed buildings for industrial, railway and power station use, both at home and abroad. Other work includes oil tanks for various parts of the world, and ships' hatches.

MICHELL BEARINGS, LTD., Scotswood, Newcastle-on-Tyne, continue to be busily engaged in the production of Michell bearings, and approximately 60 per cent of the output is for marine applications. Other fields in which these bearings are employed include turbines, pumps, vertical and horizontal generators, paper-making machinery, fans and air compressors. Plant installed since our last visit includes an Asquith 7-in. spindle, column and floor-plate type, horizontal boring and milling machine, and another Colchester 7½ in. centre lathe.

GEORGE ANGUS & CO., LTD., Westgate Road, Newcastle-on-Tyne, report a steadily maintained demand for leather and rubber belting, and for fire-fighting equipment comprising rubber hose and protective clothing. At the Angus Gear Division, Hebburn-on-Tyne, some expansion in the demand for gear-cutting is reported, and special gear reduction units are on order for nuclear power stations and for oil well pumping units. Straight bevel gear cutting capacity has been increased by the recent installation of a 24 in. Gleason bevel gear cutting machine. Norga high-pressure hydraulic gear pumps and Gamax gear reduction units are in steady request. At the Oil Seals Division, Wallsend-on-Tyne, orders are in hand for a wide range of types and sizes of oil seals, and a selection of these products will be on view at the International Motor Show to be held at Earl's Court, London, from October 22 to November 1. Various Angus products are also to be shown at the Textile Machinery Exhibition to be held at Belle Vue, Manchester, from October 15 to 25.

T. B. PEARSON & SONS, LTD., Wincomblee Road, Low Walker, Newcastle-on-Tyne, have a good order book for electro-hydraulic guillotine shearing machines and flanging presses. The former are for plates from ¼ to 1 in. thick, and for widths from 6 to 16 ft., and the latter include machines

ranging from 155- to 450-ton capacities. Our attention was drawn to a 500-ton open-fronted press, weighing approximately 45 tons, which has recently been completed for a Scottish shipyard, to which we hope to make further reference shortly. Outstanding among the fabricated steel-work contracts in hand are circulating water pipes, ducting and large stators destined for various power stations of the Central Electricity Authority.

BUMA ENGINEERING CO., LTD., Robson Street, Newcastle-on-Tyne, are engaged on a variety of work which includes Cent-ro-mic portable fine boring machines for use in shipyards and heavy engineering works, and garage equipment comprising polishing and burnishing machines, stud extractors and cylinder liner drawbars. Prototype development and precision engineering work are undertaken, also metal spraying and shot blasting.

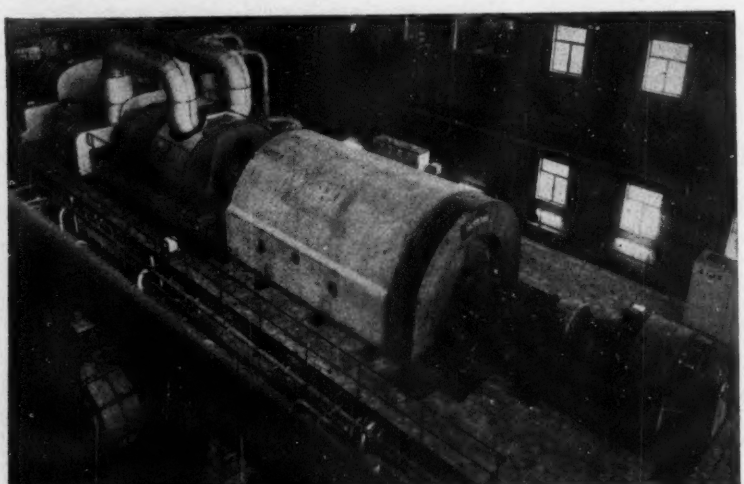
ADAMS POWEL EQUIPMENT, LTD., Team Valley, Gateshead, are well placed for home and export orders for a variety of automatic packaging machinery, including case sealers and gluers, conveying and stapling equipment. Orders have recently been received from Germany, France and various African countries. In addition, we may note orders in hand for electrical instruments and equipment, and for gyroscopes.

BREN MANUFACTURING CO. (R. W. CRABTREE & SONS, LTD.), Team Valley, Gateshead, are well employed on the production of printing machinery components for the parent company. Other activities include machine tool reconditioning work for the Ministry of Supply and private firms, and the production of Brenco precision-made unbreakable spanners, which are marketed by Macrome, Ltd., Aldersley, Wolverhampton.

QUASI-ARC, LTD., Team Valley, Gateshead (Head Office—Bilston, Staffs.), have an interesting programme of manipulators and welding heads in hand. Units of various types and capacities are being built for use in connection with the firm's automatic metal arc-welding processes, which include Fusible visible, Unionmelt submerged and Sigma inert-gas shielded systems. Our attention was drawn to the new double-ended machine for the automatic butt-welding of pipeline joints on site. Two 30- to 40-ft. lengths of pipe can be welded together, and pipes of 6 to 38 in. diameter can be accommodated without adjustment. The length of pipe is supported on two idler units, each of which incorporates six ball castors arranged in V-formation, thus allowing the pipe to be rotated for welding and allowing it to be withdrawn in the longitudinal direction. The vertical frame on which the welding head carriage runs forms a single integral unit with the roller bed frame. The arm carriage is raised and lowered manually, and the counterbalanced arm can be clamped at any desired height.

C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne, have recently installed the first of three 100 MW turbo-generators in the Ferrybridge (Yorkshire) power station, as shown in the accompanying illustration. It has three cylinders and, with the exception of a two-row velocity wheel on the high-pressure shaft, is fitted with reaction blading throughout. The machine runs at 3,000 r.p.m., and generates at a frequency of 50 cycles per sec. Initial steam conditions are 1,500 lb. per sq. in. at 975 deg. Fahr., with re-heating to 950 deg. Fahr. between the high and intermediate pressure stages. Six similar machines are on order for the Aberthaw power station, and thirteen 120 MW turbo-generators are to be built.

H. B.



**Parsons 100-MW turbo-generator recently installed at Ferrybridge (Yorks.) power station, the first of three units on order for this station**

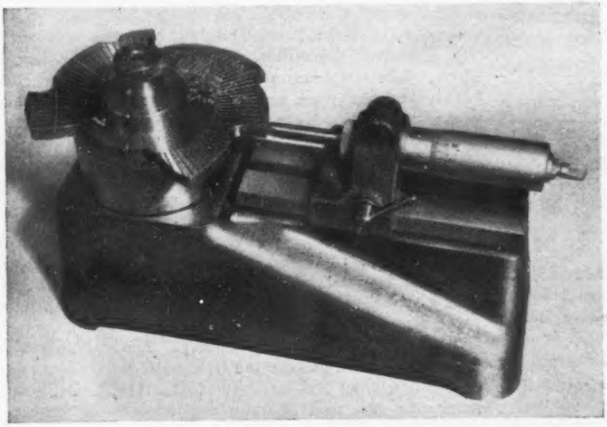
## London and the South

W. E. NORTON (MACHINE TOOLS), LTD., Grosvenor Gardens House, Grosvenor Gardens, S.W.1, report that the sales of their machine tools are being generally maintained at a satisfactory level. This firm continues to expand its activities overseas, and, in this connection, it may be noted that the associated company in Rhodesia is providing additional showroom space at its Salisbury premises, where a wide selection of machine tools, including Bronx press brakes, will be displayed. Interest in machine tools handled by W. E. Norton is increasing in the U.S.A. whence many enquiries have been received. As previously reported in MACHINERY, this firm delivers Willson Mk. I lathes in a semi-finished condition to a destination in Switzerland, where final machining and assembly is undertaken.

MOSER CAMS & TOOLS LTD., 465 Hornsey Road, N.19, are well placed for orders for cams and tools for Swiss-type and other automatics. This firm also supplies cam blanks, of which many varieties are held in stock, and Schaublin precision collets. Another activity is the production of profile ground form tools in high speed steel or with cemented carbide tips. The accompanying illustration shows a cam measuring stand made by the company. The micrometer mounting can be adjusted to enable cams of up to 12 in. diameter to be accepted. Other measuring devices, such as dial gauges, can be fitted in place of the micrometer, if desired.

BRITISH INDICATORS, LTD., St. Albans, Herts., report that their exports of dial indicator gauges to the U.S.A. are increasing, and sales in this country continue to be satisfactory. The company will shortly introduce a dial indicator gauge with a nitrided bush for sliding the stem. Extensive tests, it is stated, have indicated that this method of construction results in extended gauge life, since there is less wear of the bush due to the ingress of abrasive material. Moreover, it is claimed that the reduced friction results in an improvement in the sensitivity of the gauge movement. A system is shortly to be introduced in the inspection department whereby all dial gauges manufactured in the works will be checked by means of an indicating and recording instrument, which will provide a graphical record of the accuracy of each gauge over its full scale reading.

F. W. H.



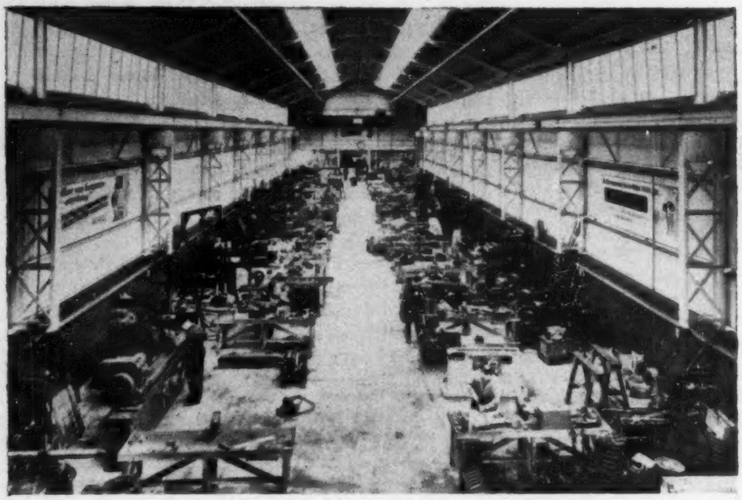
**Micrometer-type Cam Measuring Stand Made by Moser Cams & Tools, Ltd.**

## New Works for Machine Tool Rebuilding

For most of the 75 years during which I. L. Berridge & Co., Ltd., Sanvey Gate, Leicester, have been established as general and precision engineers, they have been principally concerned with the supply of machines and special parts to the Admiralty and the knitting and small arms industries. Following and expansion of the motor vehicle and aircraft industries, however, extra facilities were provided for the production of equipment and components for these important branches of engineering.

Some 10 years ago the company entered the field of machine tool rebuilding, and with a view to undertaking this type of work on a substantial scale, later acquired a 4½ acre site at Wigston, Leicestershire, where the modern shop, shown in the illustration on page 684, has since been built. With an area of more than 18,000 sq. ft., this building is accessible to large vehicles and has an overhead travelling crane with a capacity for loads up to 7½ tons. Machine tools received for rebuilding are off-loaded at the far end of the shop, as viewed in the figure, and, after being degreased, stripped and cleaned, are examined for defects and then progressed through various departments until they are restored to a condition claimed to be equivalent to that of new machines.

The combined resources of the company's shops, which provide employment for 400 people, enable machining operations and processes of many kinds to be carried out including, for example, milling, boring, planing, grinding, shot-blasting and



**Machine tool re-building shop of I. L. Berridge & Co., Ltd., Wigston, Leicestershire**

heat treatment. Among the machine tools installed may be noted Webster and Bennett vertical boring mills; a range of milling machines, the largest of which is a Herbert No. 47V; David Brown M.T. 30 gear hobber; a Kearns optimetric horizontal borer; Newall borers; a DeVlieg Spiramatic Jigmill and a Peewee optical form grinding machine. In the near future, it is reported, a Snow slideway grinding machine of 12 ft. capacity is to be installed.

I. L. Berridge also undertake the manufacture of the British F.U. variable speed units, which are distributed by the associated firm, F.U. (London), Ltd. In addition the well known Cri-Dan high speed threading machines are built at their works.

## *Industrial Notes*

An Auction Sale of Machine Tools and miscellaneous stores will be held at the Returned Stores Depot, Reed Hall, Colchester, on September 19. The auctioneers will be Fenn, Wright & Co. (Dept. N.), 146 High Street, Colchester, Essex.

The Association of Engineering Distributors will hold its next luncheon at 12.45 p.m., on September 23, at the Park Lane Hotel, London, W.1, and the Association's guest on this occasion will be Mr. T. H. Burleigh, sales manager, Firth Brown Tools, Ltd.

George Cohen, Sons & Co., Ltd., Sunbeam Road, London, N.W.10, have been engaged to dismantle the British Industry Pavilion after the close of the Brussels International Exhibition. Providing an area of 60,000 sq. ft., the floor of the pavilion is unobstructed except for the six main stanchions which support the complete structure. It is hoped that it may be possible to re-erect the building on some suitable site in Britain, when it could continue to serve the interests of industry.

Thomas White & Sons, Ltd., Laighpark, Paisley, Scotland, have resumed the publication, in a new format, of their house journal "White Lines." This journal will be published quarterly, and among other items in the first issue is an article on the use of the company's type MP automatic shaping machine in the production of wooden chairs. Details are also given of the range of Luke & Spencer knife and shear blade grinding machines, for which, as was mentioned in Machinery, 93/383—13/8/58, the firm has recently acquired the manufacturing rights.

Combustion Chemicals, Ltd., Elcot House, 33 Dorset Square, London, N.W.1, have been appointed sole concessionaires in the United Kingdom, the Commonwealth, Scandinavia, and North and South America, for the fuel oil and diesel fuel improvers known as Desulfurol and Dieselfur, which are produced by the French firm of Laboratoire Pacaut & Veyron. Desulfurol has been subjected to extensive trials in the United Kingdom, and is claimed to give improved combustion, and to reduce the amount of sulphur corrosion, also soot emission.

Priestman Bros., Ltd., have now completed the transfer of the majority of their departments from Holderness to the new works at Hedon Road, Hull, and only the parts stores will temporarily continue to operate from Williamson Street. The telephone number of the new works is Hull 75111, and the parts stores, Central 31777. The new works, of modern design, includes social and recreational amenities, in addition to facilities for the production of earth moving equipment. The site covers 40 acres, and the works comprises 160,000 sq. ft. of covered area and 32,000 sq. ft. of office accommodation.

Demonstration of Tavannes Machines.—Stanley Howard, Ltd., 73 Devon Street, Saltley, Birmingham, 7, inform us that an exhibition and demonstration of machine tools will be held by their principals, the Tavannes Machines Co., S.A., at that company's premises at Tavannes, Switzerland, from October 1 to 15, inclusive. The machines to be demonstrated will include the Gyromatic 6-spindle vertical automatics, types SSLA.190 and STLA.140, tooled up for machining cast iron housings and outer races for taper roller bearings, respectively; also a Gyromatic 6-spindle vertical bar automatic type STA. 46 and a Tavannes single-spindle automatic type M.40.

## Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

| Type of Machine | Month ended June 30, 1958 Value £ | Six months ended June 30 1957 Value £ | Six months ended June 30 1958 Value £ |
|---|---|---|---|
| New, complete— | | | |
| Boring machines: | | | |
| Vertical | 103,665 | 191,594 | 295,398 |
| Other | 54,389 | 496,787 | 463,004 |
| Drilling machines | 126,497 | 1,133,826 | 923,545 |
| Grinding (excluding thread grinding) lapping and honing machines | 110,396 | 1,441,355 | 1,089,371 |
| Lathes: | | | |
| Automatic | 56,968 | 1,029,561 | 702,017 |
| Capstan | 148,314 | 1,387,413 | 1,089,627 |
| Other | 152,625 | 1,638,321 | 1,415,561 |
| Screwing machines | 12,643 | 122,682 | 117,862 |
| Threading machines | 4,530 | 336,195 | 184,972 |
| Milling (excluding thread milling) and gear cutting machines | 158,639 | 1,277,988 | 1,172,864 |
| Planing, shaping and slotting machines | 43,173 | 403,815 | 458,819 |
| Presses: | | | |
| Hydraulic | 28,541 | 684,225 | 268,080 |
| Other | 191,166 | 393,445 | 705,296 |
| Punching and shearing machines | 28,907 | 235,821 | 230,293 |
| Other plate and sheet metal working machines including straightening rolls | 15,954 | 206,745 | 401,068 |
| All other machines | 145,419 | 1,534,653 | 1,340,708 |
| Used machines, complete | 52,219 | 358,735 | 373,190 |
| Parts | 182,217 | 1,220,614 | 1,152,363 |
| Total | 1,616,262 | 14,093,775 | 12,384,038 |
| *Destination* | | | |
| Union of South Africa | 120,568 | 774,402 | 874,238 |
| India | 303,848 | 1,892,546 | 2,078,417 |
| Australia | 282,491 | 2,056,536 | 1,768,399 |
| New Zealand | 27,957 | 205,938 | 195,584 |
| Canada | 77,486 | 1,020,228 | 851,277 |
| Other Commonwealth countries | 132,573 | 805,240 | 881,802 |
| Soviet Union | 740 | 660,809 | 64,598 |
| Sweden | 58,058 | 402,781 | 270,761 |
| Western Germany | 7,497 | 265,028 | 278,913 |
| Netherlands | 39,610 | 442,174 | 277,635 |
| France | 75,962 | 1,095,366 | 935,865 |
| Spain | 130,404 | 791,656 | 856,769 |
| Italy | 43,208 | 439,800 | 471,149 |
| U.S. America | 109,712 | 1,405,468 | 692,736 |
| Other foreign countries | 206,148 | 1,835,803 | 1,885,895 |

IMPORTS OF MACHINE TOOLS

| | | | |
|---|---|---|---|
| New, complete— | | | |
| Boring machines | 57,076 | 1,289,135 | 520,702 |
| Drilling machines | 5,615 | 259,658 | 104,657 |
| Gear-cutting machines | 51,940 | 605,197 | 342,602 |
| Grinding, lapping and honing machines | 146,514 | 1,171,791 | 1,192,787 |
| Lathes: | | | |
| Automatic | 102,702 | 1,076,383 | 1,265,102 |
| Other | 6,862 | 134,960 | 128,300 |
| Milling machines | 70,470 | 1,245,108 | 1,009,556 |
| Planing, shaping and slotting machines | 41,094 | 179,044 | 141,735 |
| Presses | 34,582 | 435,224 | 415,608 |
| All other machines | 388,600 | 2,303,295 | 2,185,754 |
| Used machines, complete | 22,386 | 183,024 | 268,393 |
| Parts | 226,014 | 2,176,176 | 1,644,819 |
| Total | 1,154,855 | 11,058,995 | 9,220,015 |
| *Country of Origin* | | | |
| Western Germany | 413,802 | 4,431,036 | 3,217,523 |
| Switzerland | 127,153 | 1,316,966 | 1,404,253 |
| U.S. America | 456,269 | 3,585,464 | 2,784,133 |
| Other foreign countries | 157,631 | 1,725,529 | 1,814,106 |

## Plant Engineers' Refresher Course

The latest in the series of refresher courses for works and plant engineers, organized by the education committee of the Incorporated Plant Engineers, 2 Grosvenor Gardens, London, S.W.1, will be held at Liverpool University, and will comprise 18 weekly lectures starting on October 30. Among the wide range of subjects covered by the syllabus may be noted: the planning and control of maintenance; the application of new materials to plant engineering; properties and treatment of metals and alloys; developments in welding practice; current techniques and future trends in the planning of plants and the operation of processes; and, the impact of automation on the plant engineer.

Copies of the complete syllabus and full details of this course can be obtained on application to the secretary to the Refresher Course, The Donnan Laboratory, Vine Street, Liverpool, 3.

## Trade Publications

UNION CARBIDE, LTD., Alloys Division, 103 Mount Street, London, W.1. List and summaries of the publications which are available, free of charge, from the company's technical library at the above address. The books are classified under various headings, namely, ferro-alloys and metals; steel production; stainless steel, properties and uses; cast iron; titanium; and miscellaneous.

## Coming Events

INCORPORATED PLANT ENGINEERS. *Birmingham Branch.* September 26, at 7.30 p.m., at the Imperial Hotel, Temple Street, Birmingham; paper on "Planned Maintenance," by A. F. R. Stedman.

INSTITUTION OF PRODUCTION ENGINEERS. *Shrewsbury Section.* September 24, at 7.30 p.m., at the Shrewsbury Technical College; film entitled "Copy Turning," with explanatory lecture by a representative of Vaughan Associates, Ltd.

INSTITUTION OF ENGINEERING DESIGNERS. *Yorkshire Branch.* September 23, at 7.30 p.m., at the Midland Hotel, Bradford; paper on "Fan-cooled Worm Gear Reduction Units," by J. W. Peake.

## Personal

MR. R. O. BIRCH, A.M.I.Prod.E., informs us that he has resigned his directorship of the B & D Tool Co., Ltd., and has severed his connections with that company. He has taken a senior executive post with Alan Keir, Ltd., North Acton Road, London, N.W.10.

DR. ALAN J. HAYTER has been appointed director in charge of the technical and sales division of Sharples Centrifuges, Ltd., Tower Works, Doman Road, Camberley, Surrey, and will be responsible for the United Kingdom and Northern European areas.

MR. H. A. HOLDEN, M.Sc., A.R.C.S., D.I.C., A.I.M., has been appointed manager of the Metal Finishing Division of The Pyrene Co., Ltd., Great West Road, Brentford, Middlesex, in succession to Mr. W. L. Baker, who has retired after 30 years' service with the company. Mr. H. F. Parshall, M.A., T.D., will continue as director in charge of the Division.

MR. JAMES HUGH NEILL, joint managing director and deputy chairman of James Neill & Co. (Sheffield), Ltd., Napier Street, Sheffield, 11, is to be installed as the Master Cutler (Master of the Company of Cutlers in Hallamshire), on October 7. He was appointed a member of the Grand Council of the Federation of British Industries in 1956. In the same year he was also elected president of the British Hacksaw Makers' Association, and was made a member of the National Federation of Engineers' Tool Manufacturers, and of the Joint Council of the Sheffield Lighter Trades Employers' Association. He was elected a member of the Executive Council of the Federation of British Hand Tool Manufacturers in 1948.

Mr. J. H. Neill

MR. H. MORLEY has been appointed general works manager of Samuel Fox & Co., Ltd., Stocksbridge Works, Sheffield, a subsidiary of the United Steel Companies, Ltd. He was formerly deputy general works manager, and in his new position he succeeds MR. J. D. JOY, who has been appointed a director and general works manager of the Appleby-Frodingham Steel Co. MR. C. M. SLOCOMBE, director and chief engineer of Samuel Fox & Co., Ltd., has been appointed director of engineering of that company, and MR. J. HAMMOND, chief engineer.

## Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £163; clean heavy copper, untinned and free from lead and solder, £157; copper, wire, No. 2, £150; clean light copper, £145; braziery copper, £129; gunmetal, £132; brass, mixed, £93; lead, net, £56; zinc, £29; cast aluminium, £90; old rolled aluminium, £110; battery lead, £29; unsweated brass radiators, £81; hollow pewter, £498; black pewter, £368.

MIDLANDS.—The difficulties in trading are still formidable, and merchants are not moving large quantities of scrap direct to consumers. Heavy steel scrap outlets in the Midlands are still closed, and practically no deliveries are being made to steelworks in other areas. The larger merchants are working on export orders, but, so far, yard stocks show little signs of diminishing, due to the large tonnages of scrap metal that are arriving each day from local factories.

Chipped turnings are accumulating in excess of the requirements of blast furnaces, and merchants are having to stock large tonnages until markets improve. Cast iron borings are moving more steadily to blast furnaces and chemical works.

The movement of bushy turnings is at a standstill, and many local factories are finding difficulty in clearing this type of scrap. Light scrap cannot be placed in large quantities, and all merchants with pressing facilities are holding large stocks of loose and processed scrap.

Foundries are taking limited quantities of short steel scrap, but, as with the various grades of cast iron, supply greatly exceeds demand.

With the information that further licences are to be granted for the export of scrap, it is hoped that there will soon be some improvement in general trading conditions.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

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* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.

† George Cohen, Sons & Co., Ltd., 600 Commercial Road, E.14.

‡ Subject to market fluctuations.

## Machine Tool Share Market

Stock markets were firm and generally cheerful during the period under review, and a good level of business was maintained in most sections, despite an unfavourable background of Far Eastern news.

The gilt-edged section was well supported and quotations of British Funds and similar high-grade investment stocks went ahead steadily and finished at the best. Commercial and industrial share markets made a bright showing in fairly active conditions. While there was some irregularity in price movements, the trend in the main was upward, and a few strong features developed.

Among machine tool issues Edgar Allen advanced 6d. to 33s. 3d.; John Holroyd B, 6d. to 12s.; Birmingham Small Arms 3d. to 31s. 9d.; Craven Bros. (Manchester), 3d. to 7s. 7½d.; John Harper, 3d. to 15s. 6d.; Samuel Osborn, 3d. to 20s.; Chas. Churchill, 1½d. to 5s. 3d.; Greenwood & Batley, 2s. 6d. to 50s. 7½d.; and Stedall & Co., 6d. to 6s. 9d. On the other hand, Arnott & Harrison lost 6d. at 14s. 6d.; Churchill Machine Tool, 6d., at 19s. 3d.; Kitchen & Wade 6d. at 8s. 3d.; Brooke Tool, 3d. at 3s. 10½d.; and Alfred Herbert, 3d. at 36s. 3d.

Craven Bros. (Manchester), Ltd. Interim dividend of 3½ per cent, an increase of 1 per cent on the corresponding distribution for last year.

## Books Received

Teddington Aircraft Controls, Ltd., Year Book, 1958. Teddington Aircraft Controls, Ltd., Colnbrook By-Pass, West Drayton, Middlesex.

This well-produced book provides a comprehensive collection of technical data relating to the complete range of equipment designed and manufactured by the company. The book is divided into 12 separate sections, and the index of items provides references to the section concerned and the relevant page number. In the section devoted to flexible metal bellows, examples are given of some of the very large bellows which the company have made for supply to various nuclear power stations, including one type which is 6 ft. in diameter and is used to effect a seal between the main duct and the biological shield of the reactor. The book has many half-tone and line illustrations.

## Obituary

Sir Frederick Charles Yapp died recently at the age of 78. When he retired from the board of directors of Vickers, Ltd., in 1951, he had completed almost 50 years' service with the Vickers Group, during which time he had been a director of many of the Group's companies.

| COMPANY | | Denom. | Middle Price |
|---|---|---|---|
| Abwood Machine Tools, Ltd. | Ord. | 1/- | 9d. |
| Armstrongs, Stevens & Son, Ltd. | Ord. | 5/- | 8/3 |
| Allen (Edgar) & Co., Ltd. | Ord. | £1 | 33/3 |
| " " | 5% Prf. | £1 | 14/9* |
| Arnott & Harrison, Ltd. | Ord. | 4/- | 14/6 |
| Asquith Machine Tools Corp., Ltd. | Ord. | 5/- | 20/- |
| " " " | 6% Cum. Prf. | £1 | 18/6 |
| Birmingham Small Arms Co., Ltd. | Ord. | £1 | 31/9 |
| " " " | 5% Cum. "A" Prf. | £1 | 15/6 |
| " " " | 6% Cum. "B" Prf. | £1 | 17/6 |
| " " " | 4% 1st Mort. Deb. | Stk. | 87½ |
| British Oxygen Co., Ltd. | Ord. | £1 | 40/- |
| " " " | 6½% Cum. Prf. | £1 | 21/6 |
| Brooke Tool Manufacturing Co., Ltd. | Ord. | 5/- | 3/10½ |
| Broom & Wade, Ltd. | Ord. | 5/- | 12/1½ |
| " " | 6% Cum. Prf. | £1 | 17/9 |
| Brown (David) Corporation Ltd. | 5½% Cum. Prf. | £1 | 14/- |
| Buck & Hickman, Ltd. | 6% Cum. Prf. | £1 | 17/9 |
| Butler Machine Tools Co., Ltd. | Ord. | 5/- | 7/- |
| " " " | 5% Cum. Prf. | £1 | 13/9 |
| C.V.A. Jigs, Moulds & Tools, Ltd. | 5½% Red. Cum. Prf. | £1 | 11/3 |
| Churchill (Charles) & Co., Ltd. | Ord. | 2/- | 5/3 |
| " " " | 6% Cum. Prf. | £1 | 26/3 |
| Churchill Machine Tool Co., Ltd. | Ord. | 5/- | 19/3 |
| " " " | 6% Cum. Prf. | £1 | 18/6 |
| Clarkson (Engrs.), Ltd. | Ord. | 5/- | 13/9 |
| Cohen (George), Son & Co., Ltd. | Ord. | 5/- | 10/6xd |
| " " " | 4½% Cum. Prf. | £1 | 14/6xd |
| Coventry Gauge & Tool Co., Ltd. | Ord. | 10/- | 16/- |
| " " " | 5% Cum. Red. Prf. | £1 | 16/3 |
| Coventry Machine Tool Works, Ltd. | Ord. | 4/- | 8/3 |
| Craven Bros. (Manchester), Ltd. | Ord. | 5/- | 7/7½ |
| Elliott (B.) & Co., Ltd. | Ord. | 1/- | 3/3 |
| " " | 4½% Red. Cum. Prf. | £1 | 13/9 |
| Expert Tool & Case Hardening Co., Ltd. | Ord. | 1/- | 1/3 |
| Firth Brown Tools, Ltd. | 4% Cum. Prf. | £1 | 12/6 |
| Greenwood & Batley, Ltd. | Ord. | £1 | 50/7½ |

| COMPANY | | Denom. | Middle Price |
|---|---|---|---|
| Harper (John) & Co., Ltd. | Ord. | 5/- | 15/6 |
| " " | 4½% Red. Cum. Prf. | £1 | 13/1½ |
| Herbert (Alfred), Ltd. | Ord. | £1 | 36/3 |
| Holroyd (John) & Co., Ltd. | "A" Ord. | 5/- | 12/- |
| " " | "B" Ord. | 5/- | 12/- |
| Jones (A. A.) & Shipman, Ltd. | Ord. | 5/- | 23/-xd |
| " " " | 7% Cum. Prf. | 5/- | 5/- |
| Kayser, Ellison & Co., Ltd. | Ord. | £1 | 45/- |
| " " " | 6% Cum. Prf. | £1 | 18/3 |
| Kendall & Gent, Ltd. | Ord. | 5/- | 7/7½ |
| Kerry's (Gt. Britain), Ltd. | Ord. | 5/- | 6/3 |
| Kitchen & Wade, Ltd. | Ord. | 4/- | 8/3 |
| Martin Bros. (Machinery), Ltd. | Ord. | 2/- | 2/4½ |
| Massey, B. & S., Ltd. | Ord. | 5/- | 8/3 |
| Modern Engineering Machine Tools Ltd. | Ord. | 5/- | 10/7½ |
| Newall Engineering Co., Ltd. | Ord. | 2/- | 4/9 |
| Newman Industries, Ltd. | Ord. | 2/- | 2/3 |
| " " | 6% Prf. Ord. | 5/- | 5/6 |
| Noble & Lund, Ltd. | Ord. | 2/- | 3/9 |
| Osborn (Samuel) & Co., Ltd. | Ord. | 5/- | 20/- |
| " " " | 5½% Cum. Prf. | £1 | 25/9 |
| Pratt (F.) & Co., Ltd. | Ord. | 5/- | 21/3 |
| Scottish Machine Tool Corporation, Ltd. | Ord. | 4/- | 5/- |
| Shardlow (Ambrose) & Co., Ltd. | Ord. | £1 | 38/- |
| Shaw (John) & Sons, Wolverhampton, Ltd. | Ord. | 5/- | 12/9 |
| Sheffield Twist Drill & Steel Co., Ltd. | Ord. | 4/- | 11/9 |
| " " " " | 5% Cum. Prf. | £1 | 15/- |
| Stedall & Co., Ltd. | Ord. | 5/- | 6/9 |
| Tap & Die Corporation, Ltd. | Ord. | 5/- | 7/6xd |
| " " " | 4½% Deb. 1961-1977 | Stk. | 82/- |
| Wadkin, Ltd. | Ord. | 10/- | 17/6 |
| Ward (Thos.) W.), Ltd. | Ord. | £1 | 80/- |
| " " | 5% Cum. 1st Prf. | £1 | 15/6 |
| " " | 5% Cum. 2nd Prf. | £1 | 24/- |
| Willson Lathes, Ltd. | Ord. | 1/- | 2/4½ |

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

# PRICES OF MATERIALS

All prices per ton except where otherwise stated.

## Pig-Iron

### Foundry and Forge No. 3, Class 2

| | |
|---|---|
| Middlesbrough zone | £21 6 0 |
| Birmingham | £20 18 3 |

### Phos. 0·1 to 0·75%

| | |
|---|---|
| Birmingham | £23 17 0 |

### Scottish Foundry

| | |
|---|---|
| Grangemouth | £25 3 6 |

### Hæmatite

English No. 1

| | |
|---|---|
| N.E. and N.W. Coast | £25 6 6 |
| Scotland | £25 13 0 |
| Sheffield | £26 15 0 |
| Birmingham | £27 4 0 |
| Welsh | £25 6 6 |

## Steel Products

| | |
|---|---|
| Medium plates | £45 11 6 |
| Mild steel plates, ordinary* | £42 2 0 |
| Boiler plates* | £44 12 0 |
| †Flat bars 5 in. wide and under; †Round bars under 3 in. | £40 0 6 |
| Billets, rolling quality, soft U.T. | £32 15 6 |

## Phosphor Bronze

| | |
|---|---|
| Ingots (2B8) (A.I.D.) d/d | nominal |

## Copper

| | |
|---|---|
| Cash (mean) | £201 7 6 |
| Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG | £271 15s. 0—£272 0 0 |
| Rods 3/16 in. to ⅜ in. diam. | £293 5 0 |
| Tubes, 1½ in. bore by 10 SWG, ton lots, per lb. | 2s. 9½d. |
| Wire rod, black, hot-rolled (¼-5/16 in.) English | £222 2 6 |

## Zinc

| | |
|---|---|
| Refined, minimum 98 per cent. purity, current month (mean) | £65 6 3 |

## Brass

| | |
|---|---|
| Tubes, solid drawn, per lb. | 1s. 7½d. |
| Strip 63/37, 6 in. by 10 SWG coils, ton lots | £228 0 0—£230 10 0 |
| Rods, ¼-3in. diam. (59 per cent copper) | 1s. 10½d. |

## Yellow Metal

| | |
|---|---|
| Condenser plates, per ton | £165 0 0 |
| Rods, per lb. | 1s. 11½d. |

## Aluminium

| | |
|---|---|
| Ingots min. 99·5 per cent Canadian d/d | £180 0 0 |

## Lead

| | |
|---|---|
| Refined, minimum 99·97 per cent purity, current month (mean) | £70 1 3 |

## Tinplates

‡U.K. Home trade:

| | |
|---|---|
| Handmill f.o.t. makers' works | £3 11 8¼ |
| Cold reduced, f.o.t. makers' works | £3 7 4¼ |

U.K. Export:

| | |
|---|---|
| Hot rolled basis, f.o.t. works' port | 72s. 6d.—75s. 0d. |
| Cold reduced basis, f.o.t. works' port | 75s. 0d. |

## Gunmetal

| | |
|---|---|
| Ingots, 85.5.5.5. ex works | £169 0 0 |

* N.E. Coast, N. Joint Area, Central Scottish Zone.

† U.T. soft basic.

‡ Official maximum price, after allowing for adjustments for increase in price of tin.

## MAKERS' PRICES

### Hexagon Steel Bars[1]

| | |
|---|---|
| Sizes in inches from 1 in. up to 2·21 and 2·41 a/f, ex works 2 ton basis | £42 17 0 |
| Free cutting black | £47 6 6 |

### Reeled Steel Bars[1]

| | |
|---|---|
| Single-reeled 1½ in. upwards, f.o.t. works (+ usual extra for sizes) | £43 9 6 |
| Free cutting | £47 19 0 |

### Precision-ground Mild Steel[2]

| | |
|---|---|
| 1-in. dia. + 0·00025-in. 4-ton lots, per cwt. | 121s. 6d. |

### Bright Ground Stainless Steel Bars[3]

| | |
|---|---|
| EN56AM (martensitic, free cutting) | £285 |
| EN58AM (austenitic, free cutting) | £353 |

### High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.

| | |
|---|---|
| Molybdenum "66" | 5s. 10½d. |
| Molybdenum "46" | 5s. 8½d. |
| 14 per cent tungsten | 5s. 9d. |
| 16 per cent tungsten | 6s. 1½d. |
| 18 per cent tungsten | 6s. 4d. |
| 22 per cent tungsten | 7s. 5d. |
| 5 per cent cobalt | 9s. 6d. |
| 4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2) | 6s. 0½d. |

### Precision-ground, High-speed Free-turning Brass Rod[2]

| | |
|---|---|
| ⅝-in. dia. ± 0·00025-in. 2-ton lots, per lb. | 2s. 5½d. |

### Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined 1/16-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

| | Per cwt. net. Mark I | Mark III |
|---|---|---|
| ½ or ⅝in. | 245s. 4d. | 318s. 10d. |
| 1 or 1¼ in. | 196s. 4d. | 251s. 10d. |
| 1½ to 1¾ in. | 137s. 10d. | 171s. 2d. |
| 1⅞ to 2 in. | 106s. 2d. | 125s. 11d. |
| 2⅛ to 3¼ in. | 91s. 6d. | 106s. 4d. |
| 3⅜ to 12 in. | 86s. 6d. | 99s. 2d. |

#### Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]

6-ft. lengths centreless ground + 0·010 in. Extra for hardenable alloy iron[5] Per cwt. net

| | |
|---|---|
| ½ or ⅝ in. | 245s. 4d. |
| 1 or 1¼ in. | 196s. 4d. |
| 1½ to 1¾ in. | 137s. 10d. |
| 1⅞ to 2 in. | 106s. 2d. |
| 2⅛ to 3¼ in. | 91s. 6d. |

### Stellite[6]

#### Welding Rods plain

| | |
|---|---|
| ¼ in. dia. per lb. | 30s. 0d. |

#### Toolbits

| | |
|---|---|
| ¼ in. sq. × 4 in., each | 22s. 3d. |

[1] Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. [2] Pratt, Levick & Co., Ltd., Chester. [3] Spartan Steel & Alloys, Ltd., St. Steven's Street, Birmingham, 6. [4] Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. [5] "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. [6] Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

## BASIC PRICES FROM LONDON STOCK[a]

### Free Cutting Steel

| | |
|---|---|
| Bright cold drawn: (Usaspead) over 1½ to 2 in. | £59 17 6 |
| Lead bearing (Usaled) | £64 4 0 |
| Precision ground, 1⅜ in. | £81 13 6 |

### Bright Drawn

| | |
|---|---|
| M.S. bars (M.M.C.) over 1½ in. to 2 in. | £55 3 6 |
| Square edge flats (Usaflat) | £72 0 0 |
| M.S. angles (Usaspead) | £99 10 0 |
| Casehardening (EN) (Usacase) over 1½ in. to 2 in. | £63 9 6 |
| M.S. bars (EN3B) (Usamild) over 1½ to 2 in. | £57 3 6 |
| Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in. | £72 19 0 |
| 35/45 ton tensile (EN6) (Usen) over 1 to 1½ in. | £64 17 6 |
| 0·4 Carbon Normalised (Usaspead "40") over 1½ in. to 2 in. | £66 19 6 |
| Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton | £127 11 3 |

### Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

### Oil Hardening Cast Steel

| | |
|---|---|
| Non-shrink (Usaspead N.S.O.H.) ⅛ in. to 2½ in., per lb. | 1s. 11d. |
| Non-distorting heavy duty (Usaspead H.C.H.C.) ⅛-in. to 2½-in., per lb. | 4s. 2d |

### Silver Steel

(0·194-in. to 1½-in.)

| | |
|---|---|
| Genuine Stubs quality, per lb. | 4s. 6d. less 27½% |
| M.M.C. quality, per lb. | 2s. 5d. + 6¼% |
| Boxes of 16 assorted sizes 1/16-in. to ½-in. dia. | 7s. 6d. |

### Stainless Steel

| | |
|---|---|
| K.E. 40.AM (Freecutting), per lb. | 3s. 3½d. |

### Glacier Machined Bronze Bars

| | |
|---|---|
| Phosphor bronze (2B8); Lead bronze | Prices on application |

### High-speed Steel

18 per cent tungsten. Prices on application.

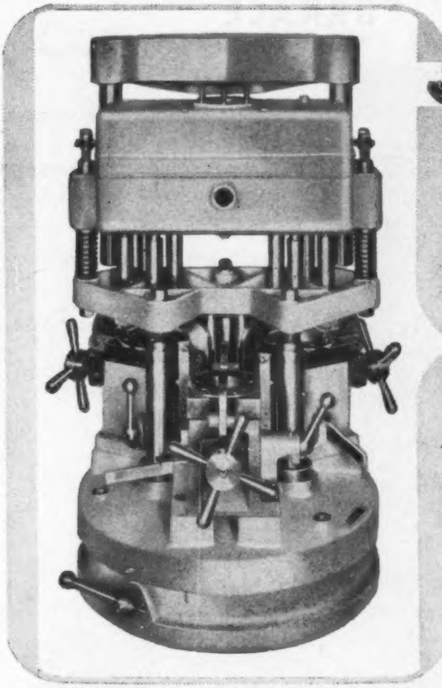
Toolholder bits:

| | |
|---|---|
| Usaspead "Super"; " "Supreme"; " Cobalt 10 | List price |

### Shimstock

| | |
|---|---|
| Steel assorted, per tin | 3s. 6d. |
| Brass " " | 7s. 3d. |

[a] Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.



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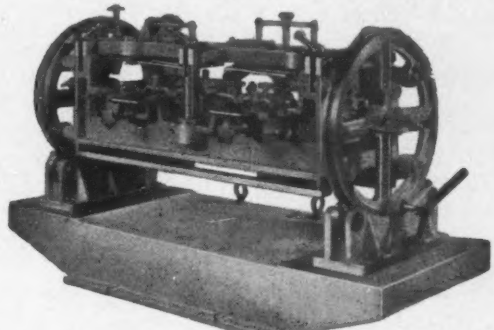

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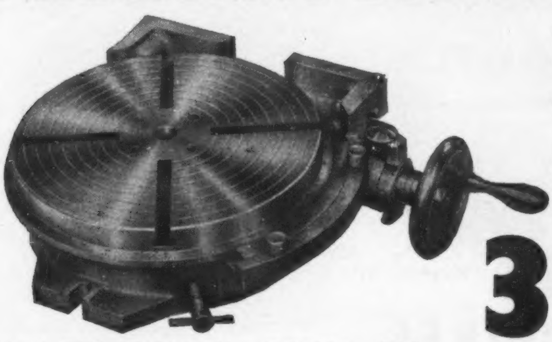

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# PRICES OF MATERIALS

All prices per ton except where otherwise stated.

## Pig-Iron

### Foundry and Forge No. 3, Class 2

| | |
|---|---|
| Middlesbrough zone | £21 6 0 |
| Birmingham | £20 18 3 |

### Phos. 0·1 to 0·75%

| | |
|---|---|
| Birmingham | £23 17 0 |

### Scottish Foundry

| | |
|---|---|
| Grangemouth | £25 3 6 |

### Hæmatite

### English No. 1

| | |
|---|---|
| N.E. and N.W. Coast | £25 6 6 |
| Scotland | £25 13 0 |
| Sheffield | £26 15 0 |
| Birmingham | £27 4 0 |

### Welsh £25 6 6

## Steel Products

| | |
|---|---|
| Medium plates | £45 11 6 |
| Mild steel plates, ordinary* | £42 2 0 |
| Boiler plates* | £44 12 0 |
| †Flat bars 5 in. wide and under, †Round bars under 3 in. | £40 0 6 |
| Billets, rolling quality, soft U.T. | £32 15 6 |

## Phosphor Bronze

| | |
|---|---|
| Ingots (2B8) (A.I.D.) d/d | nominal |

## Copper

| | |
|---|---|
| Cash (mean) | £201 7 6 |
| Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG | £271 15s. 0—£272 0 0 |
| Rods 3/16 in. to ½ in. diam. | £293 5 0 |
| Tubes, 1½ in. bore by 10 SWG, ton lots, per lb. | 2s. 9¾d. |
| Wire rod, black, hot-rolled (¼-5/16 in.) English | £222 2 6 |

## Zinc

| | |
|---|---|
| Refined, minimum 98 per cent. purity, current month (mean) | £65 6 3 |

## Brass

| | |
|---|---|
| Tubes, solid drawn, per lb. | 1s. 7½d. |
| Strip 63/37, 6 in. by 10 SWG coils, ton lots | £228 0 0—£230 10 0 |
| Rods, ¼-3in. diam. (59 per cent copper) | 1s. 10½d. |

## Yellow Metal

| | |
|---|---|
| Condenser plates, per ton | £165 0 0 |
| Rods, per lb. | 1s. 11½d. |

## Aluminium

| | |
|---|---|
| Ingots min. 99·5 per cent Canadian d/d | £180 0 0 |

## Lead

| | |
|---|---|
| Refined, minimum 99·97 per cent purity, current month (mean) | £70 1 3 |

## Tinplates

‡U.K. Home trade:

| | |
|---|---|
| Handmill f.o.t. makers' works | £3 11 8¼ |
| Cold reduced, f.o.t. makers' works | £3 7 4½ |

U.K. Export:

| | |
|---|---|
| Hot rolled basis, f.o.t. works' port | 72s. 6d.—75s. 0d. |
| Cold reduced basis, f.o.t. works' port | 75s. 0d. |

## Gunmetal

| | |
|---|---|
| Ingots, 85.5.5.5. ex works | £169 0 0 |

* N.E. Coast, N. Joint Area, Central Scottish Zone.

† U.T. soft basic.

‡ Official maximum price, after allowing for adjustments for increase in price of tin.

## MAKERS' PRICES

### Hexagon Steel Bars[1]

| | |
|---|---|
| Sizes in inches from 1 in. up to 2·21 and 2·41 a/f, ex works 2 ton basis | £42 17 0 |
| Free cutting black | £47 6 6 |

### Reeled Steel Bars[1]

| | |
|---|---|
| Single-reeled 1½ in. upwards, f.o.t. works (+ usual extra for sizes) | £43 9 6 |
| Free cutting | £47 19 0 |

### Precision-ground Mild Steel[2]

| | |
|---|---|
| 1-in. dia. + 0·00025-in. 4-ton lots, per cwt. | 121s. 6d. |

### Bright Ground Stainless Steel Bars[3]

| | |
|---|---|
| EN56AM (martensitic, free cutting) | £285 |
| EN58AM (austenitic, free cutting) | £353 |

### High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.

| | |
|---|---|
| Molybdenum "66" | 5s. 10½d. |
| Molybdenum "46" | 5s. 8½d. |
| 14 per cent tungsten | 5s. 9d. |
| 16 per cent tungsten | 6s. 1½d. |
| 18 per cent tungsten | 6s. 4d. |
| 22 per cent tungsten | 7s. 5d. |
| 5 per cent cobalt | 9s. 6d. |
| 4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2) | 6s. 0½d. |

### Precision-ground, High-speed Free-turning Brass Rod[2]

| | |
|---|---|
| ⅜-in. dia. ± 0·00025-in. 2-ton lots, per lb. | 2s. 5½d. |

### Grey Iron Rod

**Die Cast**[4] in random lengths 18 in. to 26 in. rough machined 1/16-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

| | Per cwt. net. Mark I | Mark III |
|---|---|---|
| ¾ or ⅞ in. | 245s. 4d. | 318s. 10d. |
| 1 or 1⅛ in. | 196s. 4d. | 251s. 10d. |
| 1¼ to 1½ in. | 137s. 10d. | 171s. 2d. |
| 1⅝ to 2 in. | 106s. 2d. | 125s. 11d. |
| 2⅛ to 3½ in. | 91s. 6d. | 106s. 4d. |
| 3⅝ to 12 in. | 86s. 6d. | 99s. 2d. |

**Continuous Cast**

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]

| | | |
|---|---|---|
| 6-ft. lengths | ¾ or ⅞ in. | 245s. 4d. |
| centreless ground | 1 or 1⅛ in. | 196s. 4d. |
| + 0·010 in. Extra | | |
| for hardenable | 1¼ to 1½ in. | 137s. 10d. |
| alloy iron[5] | 1⅝ to 2 in. | 106s. 2d. |
| Per cwt. net | 2⅛ to 3½ in. | 91s. 6d. |

### Stellite[6]

**Welding Rods plain**

| | |
|---|---|
| ¼ in. dia. per lb. | 30s. 0d. |

**Toolbits**

| | |
|---|---|
| ¼ in. sq. × 4 in., each | 22s. 3d. |

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester, 3 Spartan Steel & Alloys, Ltd., St. Steven's Street, Birmingham, 6. 4 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 5 "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen, 6 Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

## BASIC PRICES FROM LONDON STOCK[6]

### Free Cutting Steel

| | |
|---|---|
| Bright cold drawn: (Usaspead) over 1½ to 2 in. | £59 17 6 |
| Lead bearing (Usaled) | £64 4 0 |
| Precision ground, 1⅜ in. | £81 13 6 |

### Bright Drawn

| | |
|---|---|
| M.S. bars (M.M.C.) over 1½ in. to 2 in. | £55 3 6 |
| Square edge flats (Usaflat) | £72 0 0 |
| M.S. angles (Usaspead) | £99 10 0 |
| Casehardening (EN) (Usacase) over 1½ in. to 2 in. | £63 9 6 |
| M.S. bars (EN3B) (Usamild) over 1½ to 2 in. | £57 3 6 |
| Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in. | £72 19 0 |
| 35/45 ton tensile (EN6) (Usen) over 1 to 1½ in. | £64 17 6 |
| 0·4 Carbon Normalised (Usaspead "40") over 1½ in. to 2 in. | £66 19 6 |
| Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton | £127 11 3 |

### Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

### Oil Hardening Cast Steel

| | |
|---|---|
| Non-shrink (Usaspead N.S.O.H.) ¼ in. to 2¾ in., per lb. | 1s. 11d. |
| Non-distorting heavy duty (Usaspead H.C.H.C.) ¼-in. to 2¾-in., per lb. | 4s. 2d |

### Silver Steel

(0·194-in. to 1½-in.)

| | |
|---|---|
| Genuine Stubs quality, per lb. | 4s. 6d. less 27½% |
| M.M.C. quality, per lb. | 2s. 5d. + 6¼% |
| Boxes of 16 assorted sizes 1/16-in. to ½-in. dia. | 7s. 6d |

### Stainless Steel

| | |
|---|---|
| K.E. 40.AM (Freecutting), per lb. | 3s. 3½d. |

### Glacier Machined Bronze Bars

| | |
|---|---|
| Phosphor bronze (2B8), Lead bronze | Prices on application |

### High-speed Steel

18 per cent tungsten. Prices on application.

Toolholder bits:

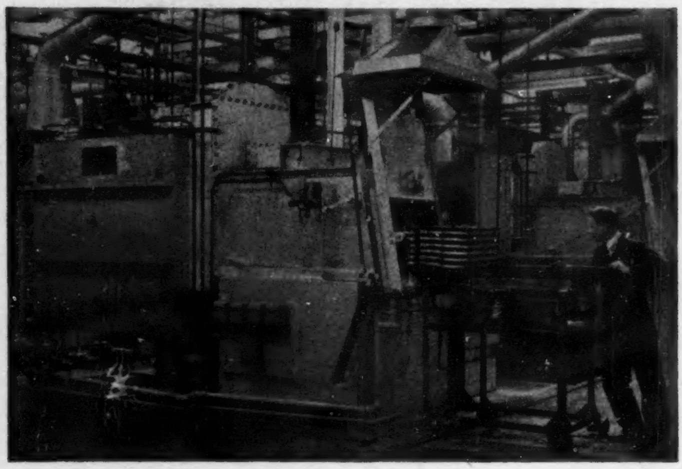
| | |
|---|---|
| Usaspead "Super", " "Supreme", " Cobalt 10 | List price |

### Shimstock

| | |
|---|---|
| Steel assorted, per tin | 3s. 6d. |
| Brass " " | 7s. 3d. |

6 Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.

# THE VERSATILE "ALLCASE" FURNACE



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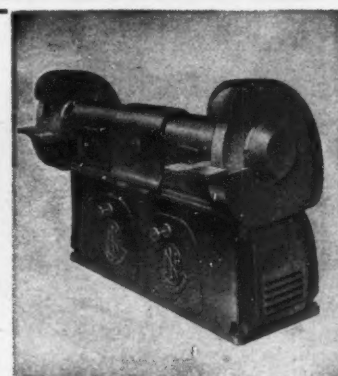

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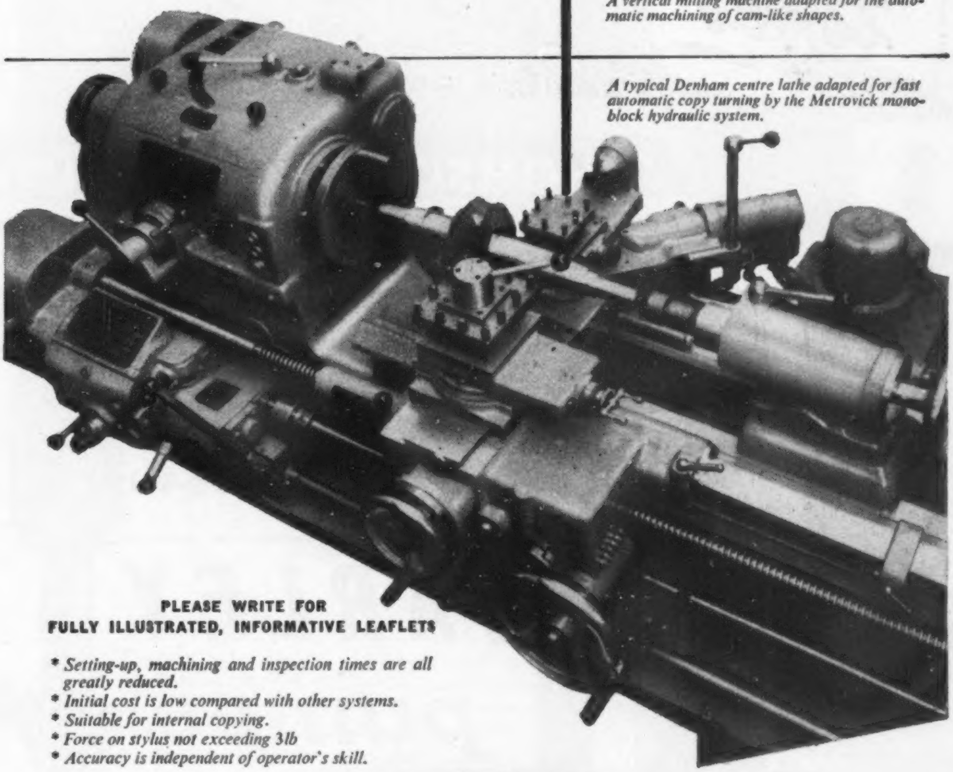

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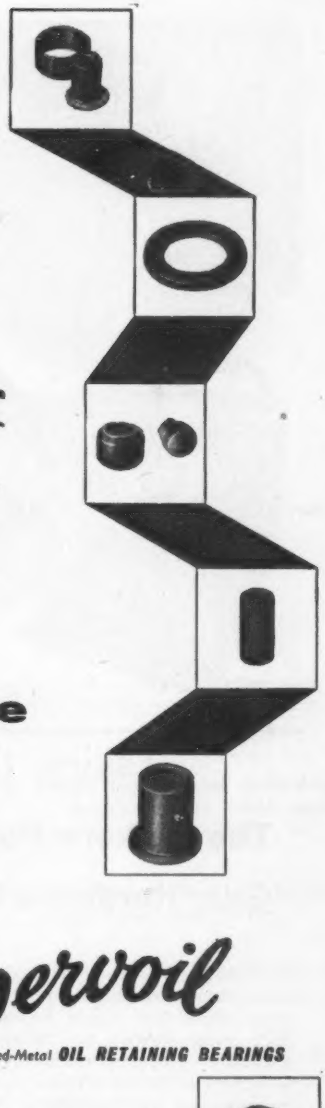
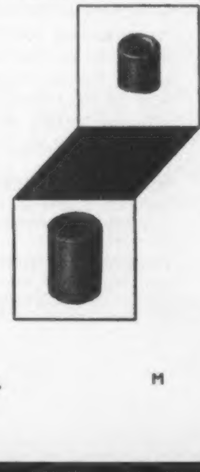






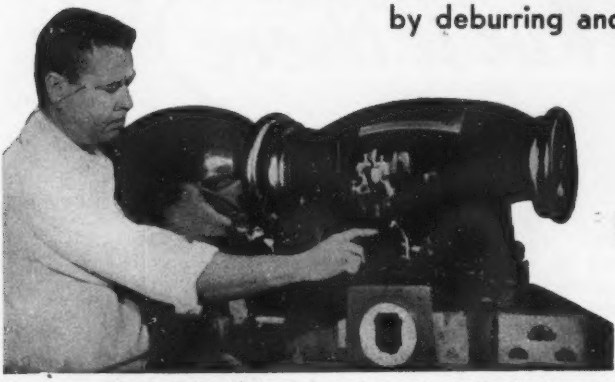
DEVELOPMENT ENGINEER AT LANDIS MACHINE CO. REPORTS . . .

# "We cut costs from £20 to 4/- per 100"

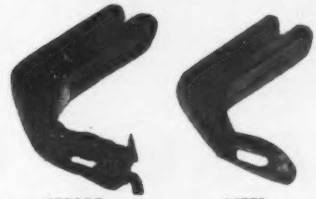
## by deburring and finishing needle plates with

## ALMCO

## Barrel Finishing Equipment



Mr. James W. Dunford, development engineer at Landis Machine Co. points to location of needle plate in new model of Landis shoe repair machine.



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**One of the most successful** barrel finishing applications on record at Almco is this needle plate deburring and finishing at Landis Machine Company.

The needle plate forgings are drilled and broached and then carefully deburred and finished. Formerly the cost of finishing and removing the tough burrs by hand filing was £20 per 100.

Now, an Almco Model DB-200 barrel finishing machine performs the same operation at a cost of 4/- per 100, a savings of 99%!

### VERSATILE EQUIPMENT

By keeping simple records on processing cycles, correct media and compound, and proper scheduling, Landis engineers can switch the Almco equipment from part to part, to meet plant production requirements exactly.

### BROAD EXPERIENCE FOR YOU

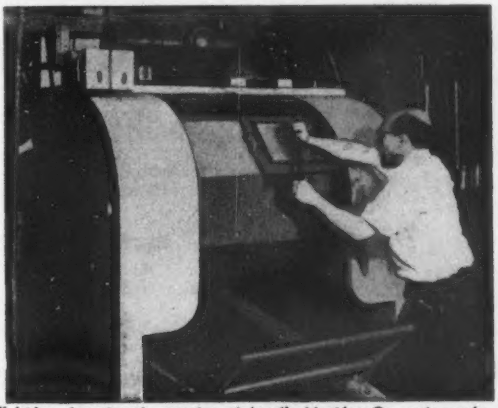
Almco's experience in barrel finishing methods and techniques now covers a wide range of parts, sizes, shapes, metals, and operations. Almco maintains sample processing laboratories for the purpose of analysing product parts and desired results. Let Almco technicians work out procedures to give you the quality you want at the lowest possible finishing cost.

### REQUEST YOUR REPORT

Simply write on your company letterhead, requesting an Almco engineer to call on you. Or, send your sample parts and specifications on results direct to Almco. You will receive a detailed report at no obligation.

### MANY LANDIS PARTS NOW BARREL FINISHED

With this £1,143 annual saving on needle plates alone in mind, Landis engineers have applied the Almco method to other parts until the company is now barrel finishing several hundred different parts to high quality standards. Rejects are practically non-existent.



Finishing department operator at Landis Machine Co. gets ready for parts deburring run in Almco barrel finishing machine. Almco construction is heavy-duty throughout, to stand up under rugged requirements month after month.

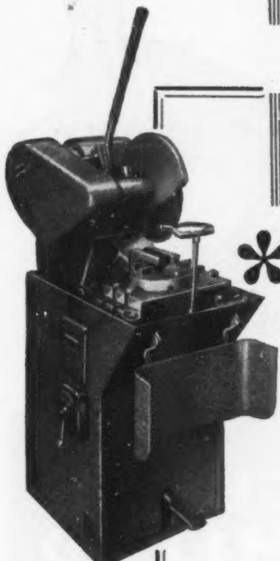
**ALMCO Supersheen** BURY MEAD WORKS · HITCHIN · HERTS

Telephone: Hitchin 3669

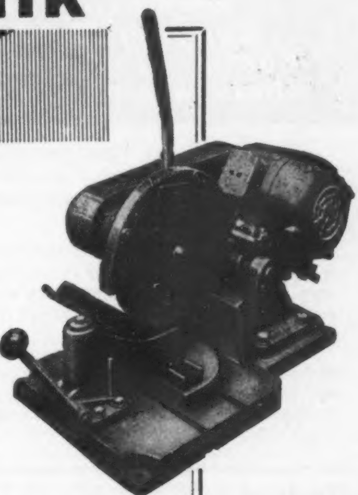
**HOLLAND (Rotterdam)** N.V. Technische Handelsonderneming "Carborundum-Aloxite" : **BELGIUM & LUXEMBURG (Bruxelles)** Tecnimetal Societe Anonyme : **SWEDEN (Stockholm)** Trumlingsaktiebolaget : **SWITZERLAND (St. Gallen)** L. Kellenberger & Co. : **SOUTH AFRICA (Johannesburg)** Barry Colne & Co. (Pty.) Ltd. : **AUSTRALIA & NEW ZEALAND (Melbourne)** Hardie Trading Ltd.

# POWA-LASTIK

* PATENTS PENDING



Pedestal Models 12" or 14" Wheels



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*CUT-OFF*

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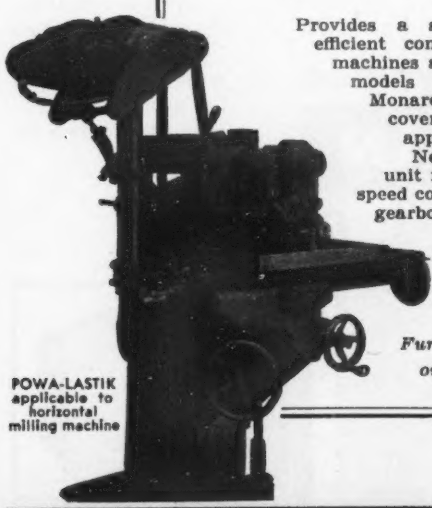

POWA-LASTIK applicable to horizontal milling machine

Gear Drive Unit Model G.1

*Further details gladly supplied on application to Dept. M.*

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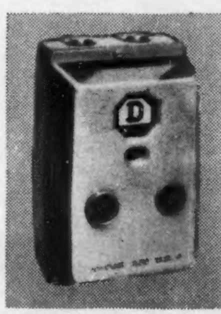

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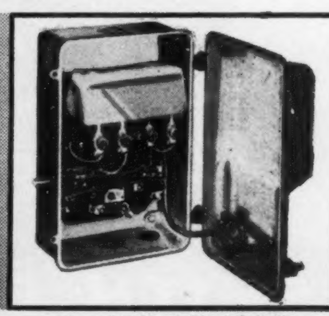

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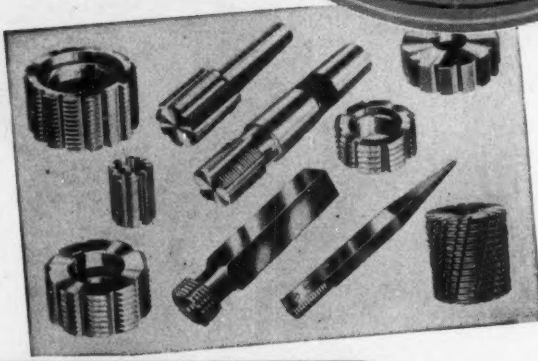

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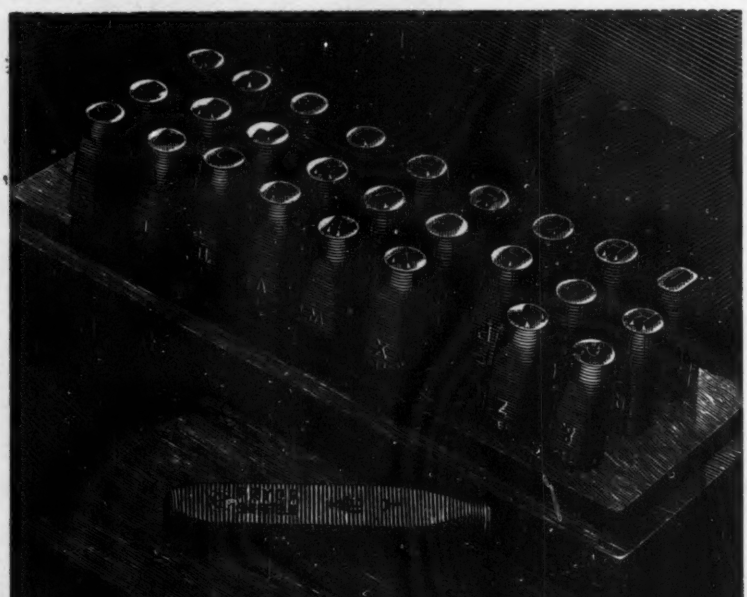

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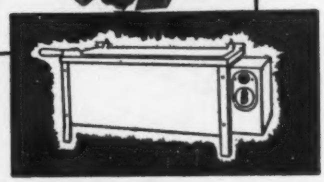

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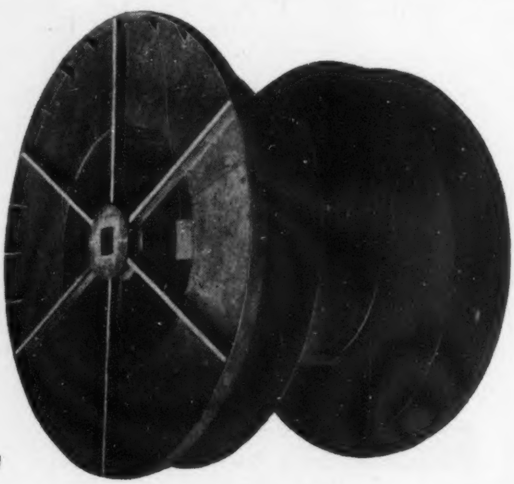

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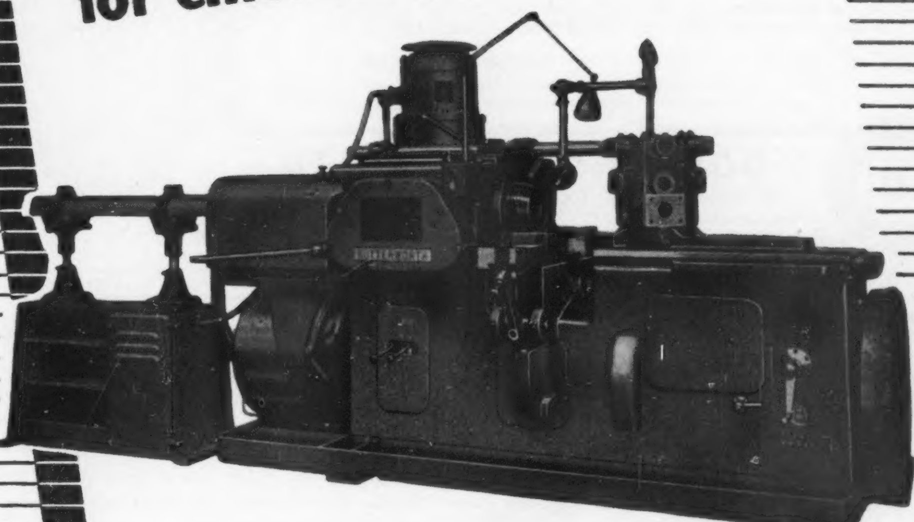

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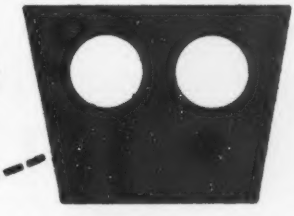

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Grommet construction makes the most efficient use of high tensile cords to produce the strongest V-belts yet made. For grommet construction ensures that *all* the cords of a belt share the load *equally*—which is the condition for maximum transmitting efficiency. Furthermore, a grommet, being an endless loop of high tensile cords, has no joints to weaken the belt, no overlapping sections to stiffen it.

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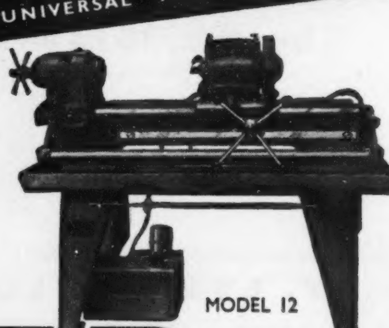

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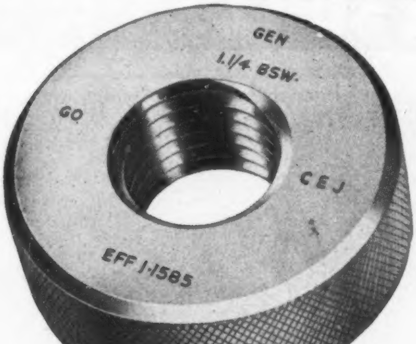


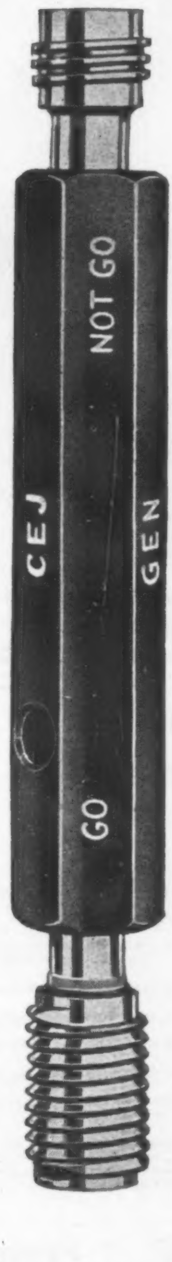


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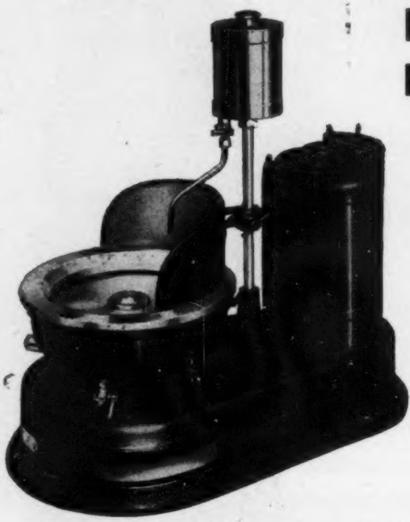

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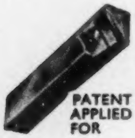
Cross Chord tool cutting S.96, 80-ton steel at 600ft./min. Depth of cut ·0035in., feed 0·06in./rev. By permission of the College of Aeronautics.



PATENT APPLIED FOR

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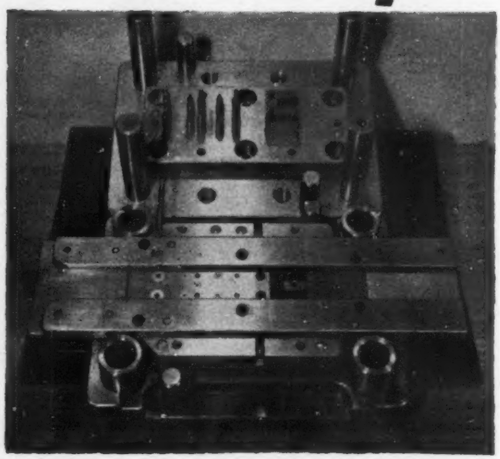

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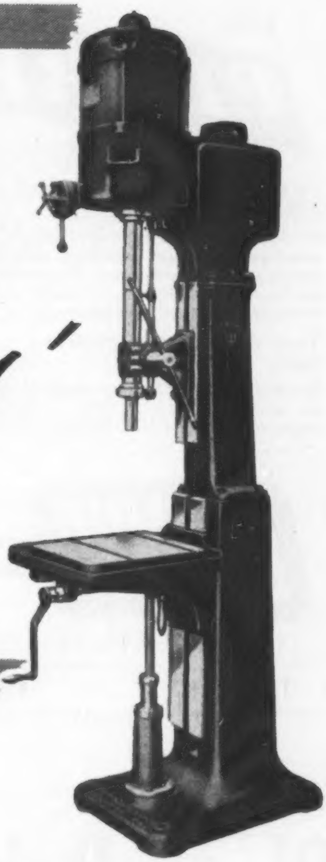

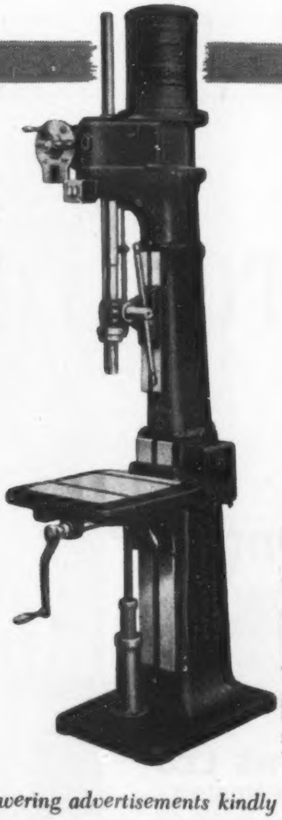

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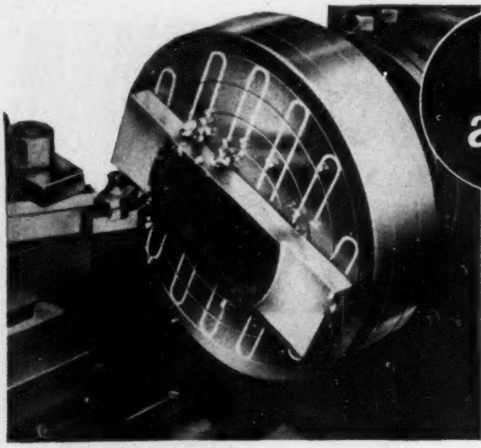

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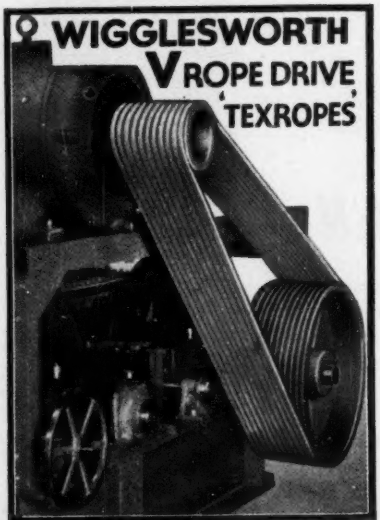


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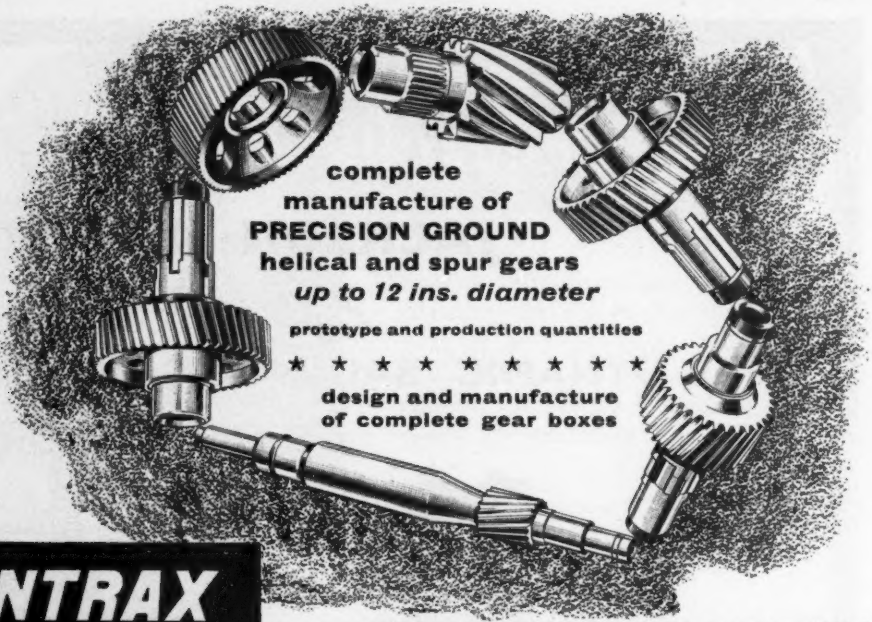







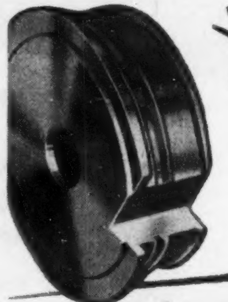

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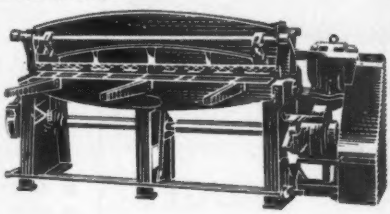

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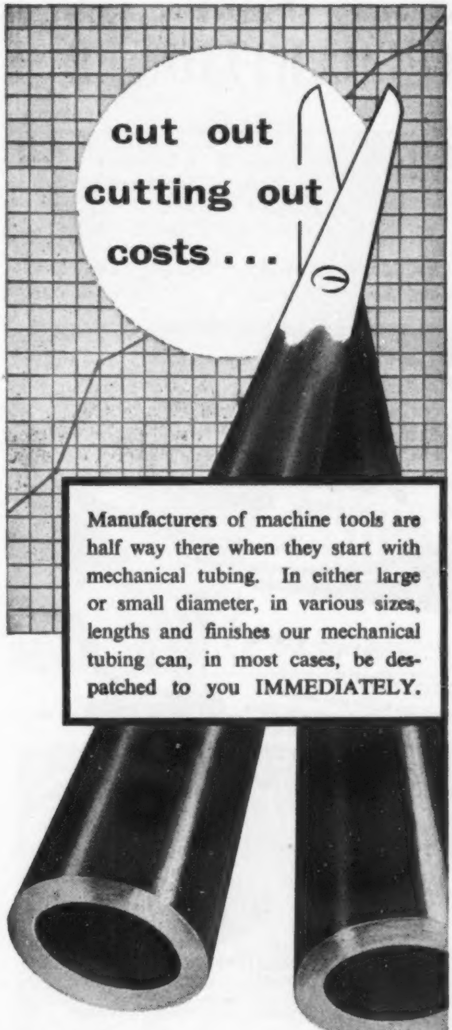


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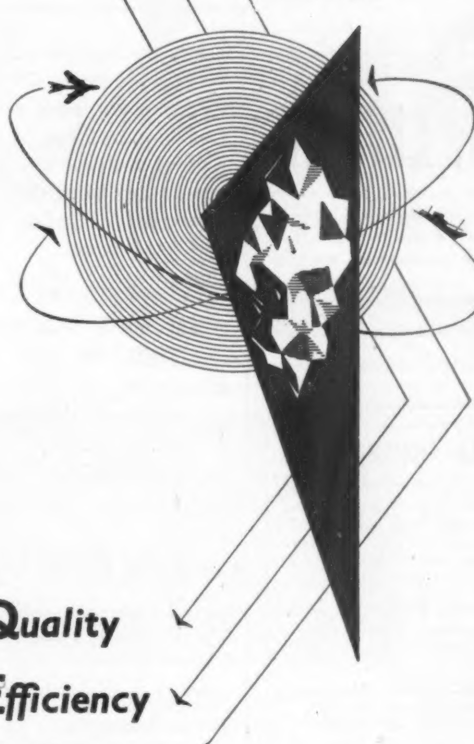

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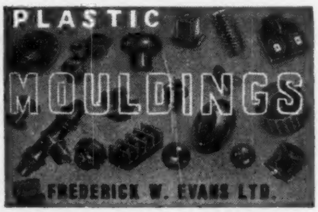


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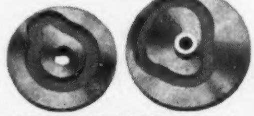

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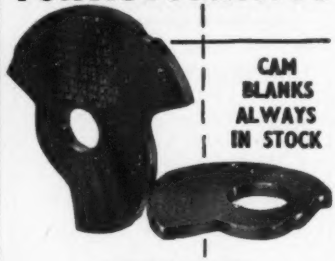


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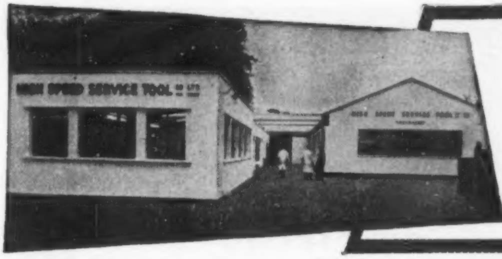

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**THE KEMWORTHY JIG & PRESS TOOL COMPANY LTD.**
**HIGH STREET, COLLIERS WOOD, LONDON, S.W.1**

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**Press Tools**

JIGS
FIXTURES
GAUGES

**JIG BORING**
***ON NEW 4G SIP JIG BORER***

THE MITCHAM JIG & PRESS TOOL Co. Ltd.
BENEDICT RD., MITCHAM, SURREY
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**IMMEDIATE CAPACITY AVAILABLE**
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**JIGS — TOOLS — AND PRESS TOOLS**
UNIVERSAL GRINDING
—JIG BORING, GENERAL
GOOD CLASS MACHINING WORK—
DESIGN OFFICE & DEVELOPMENT WORK

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**Kellering and Cam Profiling** capacity up to 8ft. by 6ft. or 6ft. diameter.
ARMYTAGE BROS. (KNOTTINGLEY), LTD.
The Foundry, Knottingley, Yorkshire.
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PRECISION
Jigs and Fixtures
Moulds and Press tools
ECONOMY
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**JIGS & FIXTURES**

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*for Structural Joints*
Brochure on High Strength Bolting, available on request.
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dmSM.38

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Made in two models covering the tapping of nuts from 1/8 to 3/8 inclusive.
Fast production, easily tooled.
Can be supplied either Belt or Motor Driven
**GEO. H. ALEXANDER MACHINERY LTD.**
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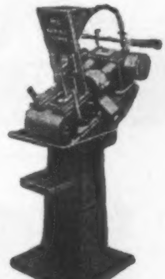

**The "Coxeter" Revolving** Centre, from 76s. All sizes from stock.—REVOLVING CENTRES, LTD., Oxford.

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**Tungsten Carbide Tool** Manufacturers of standard and special form tools in high speed steel and tungsten carbide. Our range includes reamers, cutters, workrest blades and wear-resistant parts. Carbide supplied to customers' specification and express service given for emergency tooling. DIAGRIT GRINDING CO., LTD., Marden, Kent. 'Phone: Marden 362.

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*and solderless couplings*
For protecting cables leading to motors, switchboards, starters, etc.
ALL SIZES FROM 1/4 in. to 3 in.
**THE DONOVAN ELECTRICAL CO. LTD.**
(Wholesaling Division)
GRANVILLE STREET · BIRMINGHAM 1

**'VICOUNT' EXPANDING MANDRELS**
... WITH V GROOVES
A necessity in every machine shop and toolroom. Precision-built with hardened blades. Large bearing area. Secure locking. FOUR SIZES: No. 1, 1/2in. to 1in. No. 2, 1in. to 1 1/2in. No. 3, 1 1/2in. to 2in. No. 4, 2in. to 2 1/2in.

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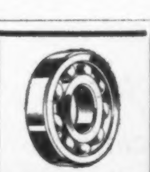
PHONE: VANDYKE 5807 & 5635



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**BRITAIN'S LARGEST STOCKS**
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**HERBERT WIDDOWSON & SONS LIMITED**

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*REAMERS, MILLING CUTTERS, END MILLS, DIEHEAD CHASERS, HAMMERS, SLITTING SAWS, LATHE TOOLS, TOOLBITS, WOLF ELECTRIC TOOLS, HEIGHT GAUGES, DRILLING MACHINES, DRILL CHUCKS, MICROMETERS, SHEFFIELD & SWISS PATT FILES, INDICATOR SETS, FLEXIBLE SHAFT MACHINES.*

*THEY'RE STOCK AT*

**RITCHIE**

*ALL SIZES OF STANDARD & SPECIAL HIGH SPEED DRILLS & TAPS FROM STOCK*

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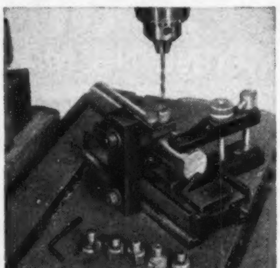
*Universal*

CROSS PIN HOLE *Drilling Jig*



Built in two sizes, with capacity of up to 1in. and 1½in. die stock respectively, this jig ensures the speedy and accurate drilling of round stock. Fully adjustable vee blocks and drill bush carrier. Supplied complete with jig bushes. *Write for details.*

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*See also Page 192 for adverts received too late for classification.*

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**SALES, SALES, SALES.** May we help you increase your Sales, in U.K. and/or Export? London Offices/Showrooms/Stores/Technical Selling Staff available. Progressive 1948 Limited Company seeks additional lines for development. Machine Tools—Factory Equipment—Tools or Allied Products. Capital, Production or Consumable Goods suitable for marketing through Engineering firms, etc. Write in confidence to

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**ENGINEERING (AUTOMATICS)**

Due to the impending retirement of the managing director an opportunity occurs to purchase the whole of the shares of a prosperous light engineering company. Modern freehold factory of 7,000 sq. ft. in Surrey. Well established goodwill with companies of world repute. Turnover exceeds £100,000 p.a. with a profit this year in excess of £25,000. This is an ideal proposition for a large company requiring automatic capacity normally placed out on a sub-contract basis. Price £75,000. Principals, their solicitors or accountants only please. Write **BOX Z.359, MACHINERY, Clifton House, Euston Road, N.W.1.**

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**Forgings and General Ironwork.** Prompt delivery.

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EAST MIDLANDS
EASTERN ENGLAND
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SOUTHERN ENGLAND
SOUTH WALES
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**WANT**
**NEW BALL & ROLLER
BEARINGS**
OF ALL TYPES & SIZES
CLAUDE RYE BEARINGS
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RENOWN 6174 (EXT. 24) · TELEX 2-3453

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**Wanted. Reasonably Modern** machine tools and sheet metal working machinery. Best prices paid.—W. FORREST & CO., LTD., Industry Works, Sylvester Gardens, Sheffield, 1 Sheffield 23314/5.

**Machine Tools, Power Presses** and Sheet Metal Machinery. Single machines or complete plants purchased. Immediate inspection.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1.

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**WANTED**
ALL TYPES OF MODERN
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*Please write or phone details to:*
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Machine Tool Division,
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**USED MACHINE TOOLS**

We offer generous prices for your plant or accept in part exchange for modern equipment

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One minute from Kilburn Park Station Bakerloo Railway

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**INSPECTION WILL BE ARRANGED AT ONCE.**

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**GOOD CLASS MACHINE tools and sheet metal machinery.**

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We pay cash for single machines or complete plants

*SEND US DETAILS*
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Props.: Exors. M. & R. Urquhart

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GOOD PRICES. Send details to
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***Wanted Urgently***

**Late Type Machine Tools**

Best Prices are offered for latest types of Machine Tools. Send us details of what you have and our representative will call to inspect.

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OFFER YOUR MACHINES TO

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Horizontal, Vertical Boring Mills; Bullard Vertical Turret Lathe; Radial Drill, Milling Machine, American Made.

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**400 TOOLS IN STOCK**
**NEW, USED AND RE-BUILT**
*Priced Brochure on request*

*Sole Agents for* **H.M.V.** (Swedish) **3·5 HORIZONTAL BORERS**

OUR STOCKS SO QUICKLY CHANGE—We cannot individually advertise the full range.

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Modern Machines—Motorised 400-440/3/50. Fully Overhauled—Six months' Guarantee.

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**CHURCHILL** VXA12 Surface Grinder.
**SNOW** OS120 Surface Grinder.
**EMIDECAU** 200 ton Hydraulic Press.
BENDING ROLLS (NEW), 6ft. 0in. × ¼in. and 8ft. 0in. × ⅜in.

**W. FORREST & CO. LTD.**
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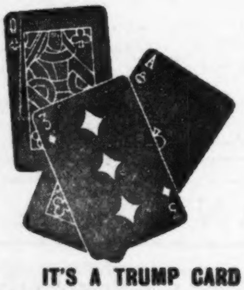
**Brown & Sharpe Automatics:** Several No. OG, No. 2G and No. 00G. All late serial numbers and in good condition. Reasonable prices. M/C's complete with stock supports, feed and speed gears.—Can be seen at MELBOURNE ENGINEERING CO., LTD., Derby Road, Melbourne, Derbyshire. 'Phone: Melbourne 232.



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THOS. W. WARD LTD
ALBION WORKS, SHEFFIELD

**600 WELDERS**

Oil-cooled pattern Arc Welders for operation on 400-440 volts single phase 50 cycles; alternatively 230 volts single phase 50 cycles; dual welding voltage 50/80; output current variable between 20/300 amps, fitted with coarse and fine regulators in robust steel tank.
£85.
Similar 250 amp. units—£71.
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**THE F.J.E. MACHINE CENTRE**
ISLINGTON PARK STREET, NEAR HIGHBURY CORNER, LONDON, N.1
(on the main A1 Road from the North)

**Scrivener No. 1 Centreless** Grinder. Capacity up to 1 in. dia. Grinding wheel 12in. by 3in. Motorised.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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*Enquiries promptly dealt with*

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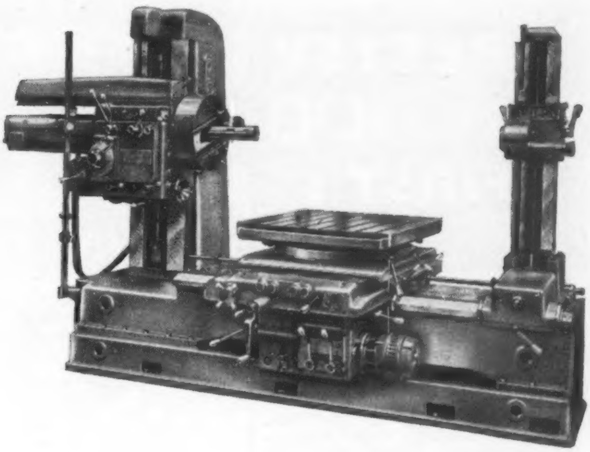
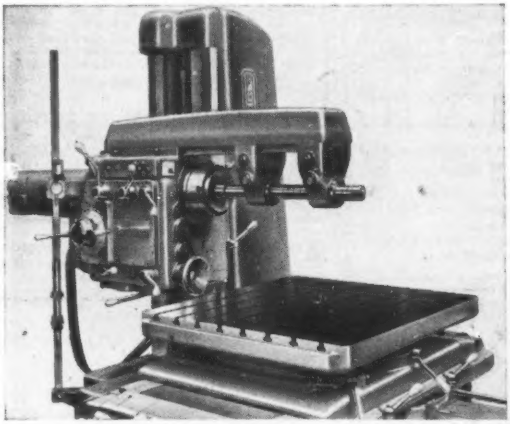
# The PBR

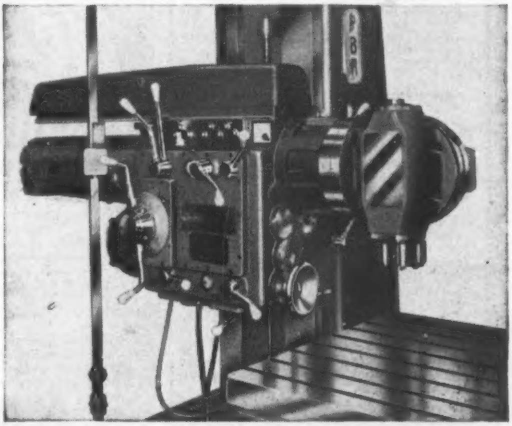


## HORIZONTAL BORING AND FACING MACHINE

| | |
|---|---|
| Spindle dia. ... ... ... ... ... | 3½in. |
| Range of speeds ... ... | 35-1,200 r.p.m. |
| Traverse ... ... ... ... ... | 24in. |
| Size of Table ... ... ... | 39in. by 34in. |
| Rotates through ... ... ... | 360 deg. |
| Max. distance spindle to table ... ... | 35in. |
| Longitudinal traverse ... ... ... | 51in. |
| Cross traverse ... ... ... ... | 32in. |
| Max. distance facing head to outer support | 88in. |
| Approximate weight... ... ... | 6¾ tons |



## THIS ALL ANGLE UNIVERSAL VERTICAL MILLING ATTACHMENT IS NOW SUPPLIED AS STANDARD EQUIPMENT AT NO EXTRA COST




**PRICE £4,950**

*Approx. £600 returnable if Duty-free Licence is issued.*

**PRICE INCLUDES**

Facing head, 17¾in. dia.
Horizontal Milling Attachment with two Arbors 1¼in. and 1½in. dia.
Universal Vertical Milling Attachment No. 40 N.S. Taper.
Open Scale Verniers.
Dial Indicators for Vertical and Horizontal Traverses.
Coolant Pump and Fittings.

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**WICKMAN** 6in. Five spindle Chucking Automatic Lathe. Max. dia. swing 6⅛in. Turning length ⅛in. to 5in. 24 speeds by pick off gears 106-1,152 r.p.m. With quantity of equipment. Motor Drive 400/3/50.

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**BROWN & SHARPE** Model 3.B. Plain Horizontal Milling Machine. Tee slotted table 45in. by 10in. 16 spindle speeds 17-390 r.p.m. Motor Drive 400-440/3/50.

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**Southwark No. 2 Capstan, 1¼in.** Cap., 12sp. speeds. Power feeds to turret. Seen working, choice of two. £130. J. & S. Horizontal Mill, 18in. by 4in. table. Motorised 400/3/50. £20. Leinen Vertical Turret Capstan Lathe, 1in. cap. with collets, etc. Seen working £285.—'PHONE: HATFIELD HERTS. 2159.

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A.H. No. 21 Combination Turret Lathe, 1945. Excellent condition. £1,750.

A.H. No. 20 Combination Turret Lathe, 1945. Excellent condition. £1,450.

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**Huller U.G.3 Radial Tapping** Machine, ½in. cap. Controlled pitch, 4ft. swing. Mot.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5

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One spare Fan Motor.
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New **EXCEL** No. 3 Hydraulic Surface Grinding Machine.
**NORTON** Universal Grinding Machine, Type "C", capacity 12in. by 36in.
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**B.S.A. LANDIS** Type "C" Plain Hydraulic Cylindrical Grinding Machine, 6in. by 30in. (Two available.)
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**EXCEL** No. 3 Horizontal Spindle Hydraulic Surface Grinding Machine, 24in. by 8in. with magnetic chuck.
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**ORCUTT** HM24 Gear Grinder, 1944.
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**RYDER WELLMAN** Horiz. Borer, 3 Insp.
**B. & S.** OOG S.S, Autos, 1942.
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**VICTORIA** U2 Mill, with dividing hds., 1955.
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**Universal (U.S.A.) Horizontal** Boring Machine, 3in. dia. travelling spindle. Table size 24in. by 48in. M/D 400/3/50.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. 'Phone: Terminus 0167/8/9.

**CHURCHILL-REDMAN** 7NM S.S. & S.C. Gap Bed Lathe. All-Geared, 400-440 volts, 3 phase, 50. 2¼in. H.S. Q.C.G.B. Admits 2ft. 3in, b.c., 26in. dia. swing in gap.

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**KEARNS** OB Horizontal Boring, Milling, Drilling and Tapping Machine, 2½in. diameter travelling spindle. Rapid power traverse to table 30in. by 36in. Fitted screwcutting, outer support, vernier scales.

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**HERBERT** 4BS Bar Capstan Lathe, fitted turret toolholders, pump, bar feed, speeds 30 to 511 r.p.m.

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**COLCHESTER MASCOT** 8½in. by 54in. All geared Head Centre Lathe, speeds 37 to 600 r.p.m. NEW.

**COLCHESTER TRIUMPH** 7½in. by 48in. All-geared Head Gap Bed Lathe, speeds 40 to 800 r.p.m. NEW.

**WILLSON** Mark V 7½in. by 48in., S.S. & S.C. Gap Bed Lathe, admits 48in., speeds 54 to 954 r.p.m. and 37 to 739 r.p.m. NEW.

**DEAN SMITH & GRACE** Type "A" 7in. by 31in. S.S. & S.C. Gap Bed Centre Lathe, speeds 11 to 490 r.p.m. Serial No. 21303.

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**STUDENT** 6in. by 24in. S.S. & S.C. Gap Bed Lathe, speeds 52 to 1,000 r.p.m. NEW.

**THIS WEEK'S SPECIAL**

**KEARNS**
No. 5 Horizontal Borer, 6in. diameter travelling spindle, facing chuck 5ft diameter, vertical traverse 7ft. 6in., longitudinal 12ft. 6in. Admits between spindle and outer support 18ft 6in. Built 1955.

Two **CINCINNATI**
3P Dial Type Plain Horizontal Milling Machines. Built 1955.

**HARRISON** Model L.6 11in. swing by 22in. between centres S.S. & S.C. Lathe, fitted with copying attachment. Sixteen spindle speeds 45 to 2,000 r.p.m. NEW.

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**RICHMOND** S.R.2 36in. Radial Drill, elevating table, suds pump. NEW.

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**CHURCHILL** HBA Automatic Internal Grinder. Wartime built.

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**All machines motorised 400-440 volts, 3 phase, 50 cycles, A.C. supply.**
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**CHURCHILL** BD Brake Drum Grinders, maximum bore ground 24in., maximum width 10in.

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**ROWLAND** Model ADD 30in. Duplex Surface Grinder, discs open 13½in., latest type. NEW CONDITION.

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**REED-PRENTICE** No. 6 Vert. Miller, table 84in. by 20in., centre of spindle to throat 28in., vertical head travel 9in., vertical spindle travel 11½in., max. spindle to table 32in., 12 spindle speeds 15 to 1,500 r.p.m., feeds 0·008in. to 0·280in.

**CHURCHILL** Type CRM Crankshaft Regrinding Machine, capacity 20in. by 84in.

**POTTER & JOHNSTON** 5D Chucking Auto swing 25in. over bed, 12in. over cross slide, 20 spindle speeds 16 to 304 r.p.m.

ALL MOTORS 400-430 volts, 3 phase, 50-cycle SUPPLY

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**No. 3U "Adcock & Shipley"** motorised all-geared Universal Milling Machine. Table 50in. by 12in., has longl-travel of 30in. Spindle speeds 20-1,400 r.p.m. Auto feed ½in.-50in. per min. all movements. Rapid traverse by separate motor. Good equipment. Post war machine.—LEE & HUNT, LTD., Crocus Street, Nottingham.

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**Newman for MACHINE TOOLS**

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**BRADFORD** 8½in. centre height by 30in. between centres Centre Lathe.

**HERBERT** No. 8 Combination Turret Lathe.

**HERBERT** No. 12 Combination Turret Lathe with comprehensive tooling.

**NILES** Centre Lathes 13½in. centre height by 27ft. between centres. (Two available.)

**BETTS-BRIDGFORD** Centre Lathe, 15in. centre height by 16ft. between centres. (Two available.)

**WARD** No. 7 Combination Turret Lathe.

**GISHOLT** Model 1L Universal Turret Lathe. (Two available.)

**LIBBY** Model 4A Capstan Lathe.

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**PONGRACZ** Single Spindle Automatic capacity 10 mm.

**CONOMATICS** 3½in. four-spindle Bar Automatics. (Three available.)

**BULLARD** 8in. six-spindle Vertical Chucking Automatic.

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**Secondhand Victoria MO Horizontal Milling Machine 30in. x 7in. working surface of table. Complete with vertical Milling and Slotting Attachments and Suds Equipment 400/3/50.**

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**"PRINCE"** Automotive Crankshaft Grinder, self-contained motor and starter, 240 volts, single phase, maximum length 45in. Well equipped.

**CINCINNATI** "Filmatic" Plain Cylindrical Grinder, 400/440 volts, 3 phase, 50. Capacity 6in. by 26in. Variable hydraulic traverse to table, plunge cut grinding.

**HUNT** Horizontal Surface Grinder, 415 volts, 3 phase, 50. Capacity 6in. by 18in. With wheel truing device and dust extraction plant.

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**Huller U.G.3 Radial Tapping** Machine. 4ft. 0in. swing. Box table. Ind. motors to head and arm.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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**Cincinnati O-8 Automatic Cycle** Vertical Mill. Table working surface 20in. by 6in.—BOX Z604, MACHINERY, Clifton House, Euston Road, N.W.1.

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**Pollard Corona 4-spindle Drill,** 8 spindle speeds to 2,940 r.p.m., with pole change motors and geared heads. No. 3 M.T.—BOX Z620, MACHINERY, Clifton House, Euston Road, N.W.1.

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**Colchester Mascot** (New), **8½in.** height by 54in. between centres S.S. & S.C. Gap Bed Centre Lathe. Motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

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HERBERT DIE BOX ¾in., 1in., 2½in. as new, from £10. NEWAL "XL" Grinder 5in. by 18in. HYD . . . . . £325.

Many other machines

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**Besco 36in. by 18g. Cramp** Folder.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. 'Phone: Terminus 0167/8/9.

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**Archdale** 18in. Vert. Milling Machine. Fixed head. £250.
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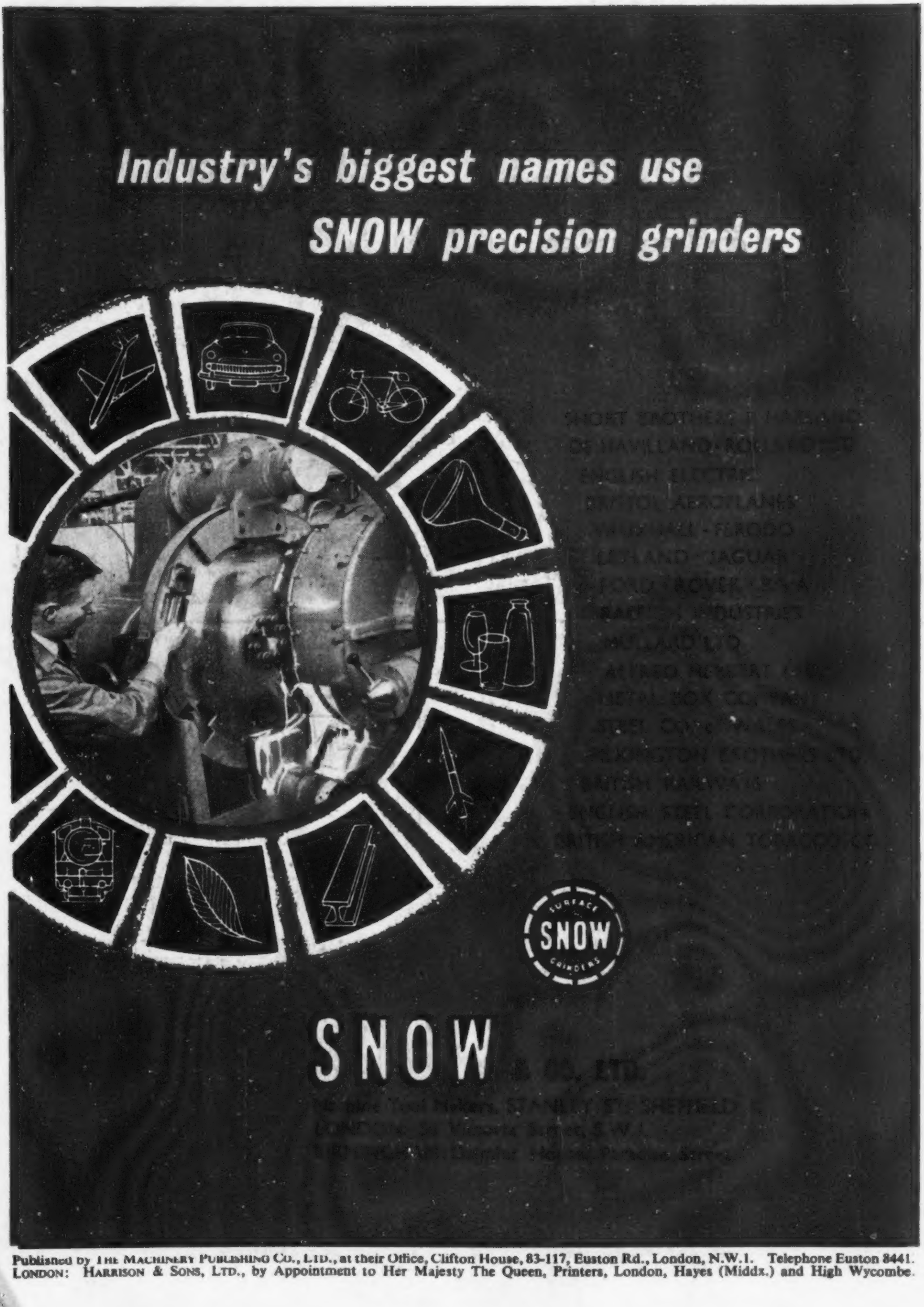


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